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TREATISE

OF THE

Urinary Passages, &c.



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Printed for J. WHISTON, and J. WOODYER, both in *Fleetstreet*.

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TREATISE

OF THE

Liber Societatis Medicæ
Urinary Passages, &c.

Medicamentis
Containing their

DESCRIPTION, POWER, and USES;

Don: Pat. Medicæ Socii
Together with the

Principal DISTEMPERS that affect them;
in particular the STONE of the

KIDNEYS and BLADDER,

As delivered at the

GULSTONIAN LECTURE in the Theatre of
the Royal College of Physicians, London.

By WILLIAM RUTTY, M.D.

Fellow of the said College, of the Royal Society,
and Reader of ANATOMY at Surgeon's-Hall.

The SECOND EDITION corrected.

Illustrated with COPPER-PLATES.

L O N D O N:

Printed for J. WHISTON, at Mr. Boyle's-Head, and
J. WOODYER, at Cæsar's-Head, both in Fleetstreet,

MDCCL.



TREATISE

OF THE



Librum hunc cui Titulus (*A Treatise of the
Urinary Passages, &c.*) dignum censemus
qui Typis mandetur.

Comitiis Censoriis ex
Ædibus Collegii nostri
Dat. 6^o Maii 1726.

Hans Sloane, Præses.

<i>Joannes Hawys</i>	}	Censores.
<i>Thomas West</i>		
<i>Gulielmus Stukeley</i>		
<i>Georgius Wharton</i>		



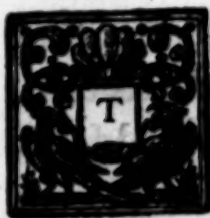


TO

Sir *Hans Sloane*, Bart.

President of the ROYAL COLLEGE
of PHYSICIANS, *London*, &c.

SIR,



HE Publication of the following *Lecture*, read by your Command, is owing in great Measure to the Request of several of the *Faculty* and others, who heard it ; but chiefly to YOUR Desire, which as soon as communicated bore with me the Authority of a Command. For HE who by his OWN Labours has brought so much Honour to the Profession in general, has an undoubted Right, I think, to
that

DEDICATION.

that of every Member in the particular Body of which he is the HEAD. Accordingly I have ventur'd to expose it to publick Censure; which from the many Defects in it, I take for granted, will be severe enough: However I dar'd not do even this without first putting it under your Patronage; well knowing that if you pronounce favourably upon it, who from your extensive Knowledge, and large Experience, are so deservedly eminent, the Generality will soften their Reflections.

YOU cannot be surpriz'd, Sir, that I should be desirous of Your Protection, if you will but reflect on Your Merit, and the Character you bear in the World. One, who has made ALL NATURE his Study, has outgone the most emulating of his Cotenporaries both at Home and Abroad, bears such a Sway in the *Physical World*, without caballing for a Reputation, or using the low Methods too frequently taken to raise one, must surely be a desirable Patron:

DEDICATION.

Patron: And if this Pittance of a Performance happens to please you as much in the Reading, as it seem'd to do upon Hearing it, I flatter myself that it will meet with your Approbation.

IN Discourses of this Sort much *Novelty* is not to be expected; the Design of them being to set before the Audience in a clear Light and narrow Compass the STATED Rules and ESTABLISH'D Laws of the Science they treat of, as well as to communicate what may have occur'd to private Observation: If therefore the Description of the Parts is just, their Uses and Powers properly ascertain'd, the Distempers incident to them rightly investigated, it is sufficient. This will answer the Design of the FOUNDER, which if I have succeeded in, it will be lucky; if any Thing is advanc'd besides, that may be of Use to the *Students* of the *Science*, I shall be very well pleas'd; and if the Performance upon the Whole is not so mean as to
be

DEDICATION.

be a *Disgrace* to that Learned BODY, of which I am a Member, and whose Honour I hold in the greatest Estimation, I shall be fully satisfied.

THE two first *Sections* of this *Lecture*, with the first part of the Third, were finish'd four Years ago, upon receiving your Orders for undertaking it; the last upon the *Stone of the Bladder* has been added since, to make the Subject more Complete. Such as it is, I now offer it to You, as a Token of my Respect, being

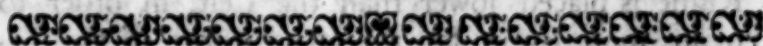
S I R,

Your very humble Servant,

William Rutty.



TREATISE
OF THE
Urinary Passages, &c.



SECT. I.



IN Pursuance to the Institution of this Lecture, which obliges me to read upon some particular Parts of the Body, and upon two or more Distempers, that are incident to such Parts, I have pitch'd upon those that are form'd for the Separation of the Urine, or are immediately subservient to it afterwards in its Passage out of the Body: which I have taken more out of Necessity than Choice; the most considerable Organs having been treated of already by some of our learned Members, whose Notions and Observations I can't pretend to amend. To this Purpose it is necessary,

B

before

before I enter upon the Diseases that affect them, to give an *Anatomical* Description of the *Urinary Passages*, and to enquire into the Nature of the Fluid secreted by them, and flowing through them, as the Knowledge of these will lead us to the *Uses* and *Powers* peculiar to each, and thereby inform us in great Measure, by what means they become so alter'd and vitiated, as to produce the *Distempers* we shall give an Account of: And by such a Method as I take it, the * *Founder's* Design will be best answer'd, in ordering this Lecture to be read over a *human Body*.

THE first then that are concern'd, and present themselves to our Inspection, are the *Kidneys*: Which, as is commonly known, are *situate* in a Duplication of the *Peritonæum*, one on each Side; the Right between the *Liver* and the *Musculus Lumbaris*, or *Psoas*; the Left between the *Spleen* and the same Muscle on that Side. In human Subjects the Right is placed lower than the Left, in order to make more Room for the large *Viscus* of the *Liver*, as in Brutes frequently the contrary; not only as the prone Situation of their Bodies does not require such a Position, the Liver in them projecting forwards and downwards, and thence leaving a greater Space for the right Kidney; but because these Animals being very voracious, their Stomachs are often so distended with Food, that it was necessary to place the left Kidney lower, to prevent its being compress'd by this Organ (together with the Spleen) during so great a Distension.

THE Kidneys are *cover'd* with two Coats or Membranes; the exterior of which is borrow'd from the *Peritonæum*, and envelops them but loosely,

* Dr. GULSTON.

generally

generally abounding with Fat; which not only lubricates their Surface, but forms a proper *Nidus*, wherein they lay secure from the Pressure and Action of the circumjacent Parts. Their interior or proper Coat is only a Production of the outer Integument of the Blood-Vessels, for which Reason it adheres closely to their Surface; though not so firmly, but it may be separated from it, without any considerable Laceration of their Substance.

THEY are connected to different Parts, in order either to keep them in their just Situation, or to communicate their proper Fluids to each other. The *Tunica adiposa* strongly affixes them to the Loins, and prevents their falling down into the Cavity of the *Abdomen*, which would occasion the Sides of the emulgent Vessels to collapse at their Orifices next the great Blood-Vessels, and thereby take off any Communication between them and the Kidneys. As a farther Security, the Right is sometimes connected to the Liver, sometimes to the *Intestinum cæcum*, and the Left to the *Colon* and *Spleen*. They communicate with the *Aorta* and *Vena Cava*, by means of the *Emulgents*, and *Arteria*, and *Vena adiposa*, and have a near Relation to the Bladder by means of the *Ureters*.

THEY have *Nerves* from the Intercostals and spinal Marrow, which together form the *Plexus Renalis*, though very few in Number, and their Twigs very small; seeming only design'd to be subservient to the other Vessels that are immediately employ'd in the Secretion of Urine: But they are pretty plentifully stock'd with *Lymphaticks*; some of which coming out of their *concave* Side, and making several Anastomoses in various Places, are at length inserted into a Gland in human Bodies, and thence carry the Lymph to the *Receptaculum Cbyli*;

whilst others arising from their *gibbose* Side, form a double Trunk: One of which creeping upwards, the other downwards along their Back, and both making a Flexure towards the Emulgent Vessels, terminate likewise in a Gland, and thence proceed to the same Receptacle. These Lymphaticks spring from so minute an Origin, that it escapes the Eye, though assisted by the best Microscope, which has occasion'd Variety of Conjectures concerning them: But *Nuck's* Experiments*, from whom I have taken this Account, (not being able myself to trace their Beginning) have taught us, that they arise from the Capillary Branches of the Emulgent Arteries: For by blowing into this Artery, the *Flatus* easily pass'd into these *Ducts*, and distended them. As this Experiment demonstrates the Communication between these Vessels, it at the same time gives us an Insight into the Use of the *Lymphaticks* of these Parts; which is to receive and carry off the *Lymph* from the Blood brought for the Nourishment of the Kidney, as the Urinary Tubes receive the excrementitious Parts, or the Urine.

WE come now to the *Body* of the *Kidneys*, whose external Superficies in *Adults* is uniform and even, but in *Infants* rough and unequal, being divided as it were into distinct Lobes; which has made several imagine the *Kidney* to be compos'd of a Number of conglomerate Glands: But its *inward Structure* has occasion'd a great Variety of Opinions † suitable to the Philosophy in Vogue at the Time the Authors wrote concerning them: To examine which is now altogether needless, because the modern Improvements in Anatomy have demonstrated them to be so many Fictions of learned Men. It

* *Nuckii adenographia*, cap. 6. p. 61. † *Vid.* Aristotle, Galen, Vesalius, Fallopius, Highmore, Veslingius, Bartholin.

will however be worth while to take Notice, that the great *Hippocrates* * observing the Matter contain'd in the Glands to be White, and resembling Phlegm or *Pituita*, ascribes a Use to them of receiving any Redundancy of Moisture in the Body, which by the peculiar Sponginess of their Substance they attract; and accordingly tells us, that the *Kidneys* abounding with much Humidity have *Glands*, and these larger than in any other Part. From this Description of the Largeness of these Glands, it is certain *Hippocrates* did not say this from observing the inward Structure of the *Kidneys*, but from reflecting on the Quantity of Urine proceeding from them; which, according to his Notion, must have Glands proportionably large to attract and percolate it. But however, what he concluded from his penetrating Sagacity laid a good Foundation for farther Anatomical Inquiries into their Make; which it is a Wonder were attended for so many Ages after him with so little Success, excepting only by *Aretæus*, who says the same Thing †. And indeed I must say thus much for the Honour of this great Father of Physick, (tho' it has been endeavour'd to make us believe the Contrary) that even in this knowing Age || whoever will take the Pains to read him, and has the proper Requisites to understand him, will find *Gains worthy of his Labour*, and upon many Accounts become the better Physician for it.

THE first Author, who gives a Description of all the constituent Parts of the *Kidney*, that comes near the Fact, is *Bartbolomæus Eustacbius*, a Scholar and Cotemporary of *Vesalius*. He observes, that

* Lib. de glandulis. † Lib. 2. de Causis, &c. Acutor Morborum, cap. 3. Id. diuturnorum morb. cap. 4. || Blackmore's Preface to his Essay on the Small-Pox.

in some Animals, as Bulls, Bears, &c. the *Kidneys* have *Glands*, which appear very conspicuous, both in the exterior and interior Part of them: but that in human Bodies these glandulous Substances are found in the inmost Part of the *Kidney* only *, and are plac'd in that particular Part of it, where the Branches of the *Ureter* terminate, covering the Extremity of each Branch; which Glands being divided lengthways, certain Furrows or little Channels may be perceiv'd, like so many small Hairs, through which he does not doubt, but that the Urine percolates †. This Account has a very near Resemblance of their real Structure; but at the same time it proves, that he mistook the *Carunculae Papillares* for Glands, as he did the Interstices between the Urinary Ducts for Channels to convey the Urine; for he does not admit of any Tubes for this Purpose; but in Opposition to some, who imagin'd these small Filaments might be so many minute Vessels, he give it as *his* Opinion, that they are only Furrows elegantly engrav'd in the Substance of the *Kidney* ||.

THESE Mistakes are rectified by *Bellini*, who was the first Discoverer of the *Urinary Ducts*; (tho' very likely the former Author gave him the Hint) and has also shewn from whence they spring, and how they are propagated §. From what has been wrote by him, and from reiterated Inspections and Experiments since his Time, it appears, that the Substance of the *Kidney* is only a Congeries of Blood-Vessels and Excretory Ducts wrapt up in one common Covering: For the *Emulgent Artery*, (*Tab. I. Fig. I.*) which goes off from the Trunk of the *Aorta*, in its Progress toward the *Kidney* divides first into

* De Renum structura, cap. 2. † Id. cap. 7. || Id. cap. 37.
§ De structurâ Ren. p. 19.

two Branches, and these again into two, three, and sometimes four more, which pierce the concave Side of it; when they immediately disperse themselves between the Coats of the *Pelvis*. These at their *Exit* from hence, send off smaller Branches; which being incurvated, and meeting each other, form several *Anastomoses*. From these towards the *gibbose* Part of the *Kidney*, arise still more minute Ramifications, which are propagated to the outer Superficies, and by their different Convolutions and Contortions there form a Sort of Net-work, (*Fig. II.*) not unlike a Ball of Silk; but before their ultimate Branches lose their Form, and assume that of *Excretory Ducts*, they change their circular Progress into a Serpentine one*. From the Extremities of these capillary arterial Branches arise the *Veins*, which being divided into the like Number of Ramifications (though differently modified) are inclosed in one common *Capsula* with the Artery, and accompany it throughout the whole *Kidney*, going out where the Artery enters, and terminating in the *Cava*. In some Brutes of the Cat-kind this Vein is differently dispos'd; for instead of accompanying the Artery within the *Kidney*, it propagates its Branches upon the *Surface*, as you may see in some very curious Preparations of Mr. *Ranby's* here given. (*Fig. V.*)

NEXT within these appears a Number of small Filaments, which look like *fleshy* Fibres, but are really *membranous* and *hollow*, and agree with other Excretory Ducts both in Substance and Use. These were first found out by *Bellini*, and are therefore call'd *Tubuli Belliniani*: (*Fig. III.*) They seem to spring from the Sides of the capillary Arteries, and extending themselves in a right Line

* *Ruyfch. Thesaur. 6. p. 13.*

A Treatise of the

towards the Centre or *Pelvis* of the Kidney, are collected at their Extremities into twelve Classes, and form the *Papillæ*, which are nothing else but the Endings of these Ducts so collected together, and not *Glands*, as *Eustachius* suppos'd. The remaining Part of the Kidney is possess'd by a Dilatation of the *Ureter*, which forms the *Pelvis*, and then sends off twelve Branches call'd *Fistule Membranaceæ*, which join the *Papillæ*, and have Fat interspers'd between each of them for the Lubrication of their Substance.

THIS Disposition and Communication of the Vessels in the Kidneys easily appears, by blowing into the Emulgent Artery, or injecting a colour'd Liquor into it, which will not only very much distend the whole, but will pass into the Emulgent Veins, the Tubes just mention'd, and sometimes the *Ureter* itself.

BUT besides this aggregate of Vessels, the accurate *Malpighius* has observ'd a considerable Number of exceeding small Bodies, of a round Figure like the Eggs of Fish, which are annex'd to the Ends of the Arteries, and plac'd between them and the *Tubuli Urinarii*; to the last of which they are likewise join'd by their proper Excretory Ducts, and correspond to them in Number; and which upon filling the Emulgent Artery with Ink, will also, he says, appear ting'd with it, and their Adhesion to the Capillary Branches thereby discover'd*. This has occasion'd Anatomists to differ about the Structure of this Part of the *Kidney*: *Malpighius* will have these Appearances to be distinct *Glands*, and the immediate Instruments of the Secretion of Urine.

* De Renibus, cap. 3.

THE curious Dr. *Ruysch* absolutely denies that there are any such vesicular Bodies in this Part, and confirms his Judgment by repeated Injections, which discovered the immediate Continuity of the Arteries and Urinary Ducts without any intervening Substance : * He acknowledges indeed to have observ'd certain round diaphanous Bodies in the middle of the Kidney, but they were not in Number sufficient to answer the End assign'd ; † and even these vanish'd upon Injection, and consequently could not be Glands §. The Question between them then is not whether there are *Glands* in the Kidney, for they both allow that ; but concerning the intimate Structure of that particular Part of them, which is the immediate *separating Organ* : The one being of Opinion that the Blood is alter'd, or in other Words, the Urine is secreted in these membranous Follicles, which afterwards empty themselves through their own proper excretory Ducts into those of *Bellini* : The other, that there are none such ; and if there were, yet that they are not distinct Glands, but that the Percolation is simply made by the Orifices of the *Bellinian* Ducts themselves.

IF it be lawful in *this Place* to enter into the nicer Parts of Anatomy, we may observe, that Dr. *Ruysch*'s Assertions are very much confirm'd by several Preparations of this Part ; in which the spherical Bodies that seem to be so many Glands before they were injected, appear after it to be only the Convolutions of the capillary Branches of the emulgent Artery, which the injected Liquor subtilly permeates, and passes directly thence into the *Tubuli Urinarii*. This is more easily seen in the Kidneys of Infants, which are the properest for this Purpose,

* Thesaur. 2. pag. 64, 65.
faur. 1. p. 35, 58.

† Id. pag. 65.

§. The-

A Treatise of the

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* Thesaur. 2. pag. 64, 65.
faur. 1. p. 35, 58.

† Id. pag. 65.

§. The-

because they are of a looser Contexture, and divided in a manner into Clusters of Glands; so that if these membranous Follicles would appear at all, they would in such Subjects. Whether, as some will have it, the Injection at the same time it fills these *Vesiculae*, does not introduce such a Confusion, by enlarging their Dimensions, and making them press against one another on all Sides, that the exceeding thin Membranes which compose them can't be distinguished from the injected Matter itself, is not so easy absolutely to be determin'd; nor whether from the Distension it makes in the Vessel it flows thro', it may not compress such others as lie contiguous and are not injected; at the same time it makes the one visible, totally obliterating the other: But it is not likely that it produces such Effects, because in other Preparations of this Sort, we find that it discovers the natural Contexture of the Part, which renders Dr. *Ruyseb's* Notion more certain and probable.

HOWEVER, admitting there are such membranous Bladders where *Malpighius* has plac'd them, which the Favourers of this Assertion strenuously contend for, from the regular Appearances in his different Experiments*, and from other Observations of their own, especially upon morbid Kidneys, in which they have been found pretty large and turgid with Urine, when the Urinary Ducts have been obstructed†; yet that they are *distinct Glands*, and the proper *secretory Organs* of the Urine, is no way agreeable to Nature in other Parts of the like kind; because where-ever we find these Follicles with their own proper investing Membranes and excretory Ducts, they don't perform the Office

* *Malpighii Epist. ad Spon. p. 25.*
ademie des Sciences, An. 1705. p. 40.

† *Memoirs d'Aca-*

of a Gland, but are only *Appendages* of it, or Receptacles to contain the Fluid already separated by the Gland, till it is proper to discharge it into some common Outlet, analogous to the *Vesiculæ Seminales*, *Gall-Bladder*, and such like. And by the way, in this consists one Difference in the Composition of the Glands of the Body: That those Glands which secrete a Liquor, that is afterwards to be discharg'd from them at *distant Intervals*, as occasions require, are furnish'd with these membranous Follicles, into which the separating Canal empties its Contents; which are reserv'd there for that Purpose; such are the *Mamillary Glands*, those of the *Stomach* and *Guts*, and several other in different Parts of the Body: As on the contrary, those Glands which separate a Fluid that is *continually* to flow from them to some other Part, have no such Provision within their Substance, neither do they want it; of which sort are the *Brain*, the *Testicles*, several of the conglomerate kind, and the *Kidneys*. This Distinction, founded upon the strictest Inquiries, may in some Degree decide the Controversy now depending between Anatomists concerning the peculiar Make of these Bodies*; for both are in the right, when they confine their Assertions to *particular* Glands, as they both err, when they extend them to the whole *Genus*. But to return,

THE remaining Part of the Kidneys, as before observ'd, is possessed by a Dilatation of the *Ureters*, which make the *Pelvis*; these at their *exit* from hence contract their Dimensions, and form each of them a small *Tube*, which runs with a tortuous Inflection to the Bladder. (*Fig. V.*) They are naturally of the Bigness of a Goose-Quill; but are capable of being distended to a much greater Size,

* *Boerhaave de Fabricâ Glandularum.*

as is evident in some calculous Cases; of which Sort I have seen two remarkable Instances, where their Orifices were so enlarged, that upon injecting the Bladder, in order to perform the high Operation of Cutting for the Stone, the Water passed into the very *Pelvis* of the Kidney, so that the Bladder was never distended, which appear'd to be the Case upon Dissection. They are of unequal Diameters in different Parts of them, being contracted and dilated alternately throughout their whole Length, and not in that *single* Part only, where they descend over the *Iliack Arteries*, according to the common Opinion. This appears by making a Ligature at one End of the *Ureter*, and after having inflated it, closing the other Extremity, and letting it dry. Hence *Morgagni* * rightly infers, that this alternate Contraction and Dilatation proceeds from their natural Conformation; to which I may add for a particular Design too, which will presently appear, and not only because their Sides are compressed by the Pulsation of the *Iliack Arteries*, which Mr. *Cowper* assigns as the sole Cause of this Inequality of their Dimensions †.

THEY are composed of three *Coats*, which make them more than ordinary thick in Proportion to the Space they enclose, and enable them the better to resist the Weight of the distended Intestines, (and in Women the *Uterus* likewise) which might otherwise so compress them, as to hinder the Transflux of Urine. Anatomists particularly describe the Substance of these Coats, and call the outer *Membranous*, the middle *Muscular*, and the innermost *Nervous*: But upon the nicest Inspection, there is no such Distinction appears, but the whole

* Adversar. 2. Animadvers. 47.
Tab. IV.

† *Cowper's* Appendix,

seems to be a thick nervous Membrane; in the Inside of which are placed divers small Glands that emit a *Mucus* to guard them from the Salts of the Urine.

THEY are inserted into the Bladder very obliquely, after having passed about a Finger's Breadth between its Coats, and are remarkably contracted at the Place of their opening into it. They are furnish'd with Arteries and Veins from the Trunks of the *Aorta* and *Vena Cava*, and have Nerves from the Intercostals and spinal Marrow; which last render them extremely sensible, and occasion that excessive Pain upon any forcible Distention.

IN the common Course of Nature there is only *one Ureter* to each Kidney; but sometimes she furnishes both of them with *two*, when unavoidable Necessity requires such a Deviation from her general Rules. *Double Ureters* have been often observ'd, but seldom to *both* Kidneys, as in the Preparation following; (*Tab. II. Fig. I.*) in which may be observ'd, that there are *two Ureters* arising distinctly, the one above the emulgent Vessels, the other below them, which running separately almost, their whole Course, are at length conjoin'd just at their penetrating the outward Coat of the Bladder, and there forming one *Tube* terminate in a single Orifice as usual.

SUCH an extraordinary Provision in this Subject was absolutely necessary from the uncommon Structure of the Kidneys; in which the *Fistulae Membranaceae* do not discharge themselves into one common *Pelvis*, but into *two* distinct ones; which not communicating with each other, but being separated by the Substance of the Kidney, it was requisite that

that *each* should be furnished with its proper *Uræter*, to carry off the Urine sent into it.

WE come now to the grand Receptacle of the Urine, the *Bladder*. This is situate in the *Pelvis* of the *Abdomen*, between a Duplicature of the *Peritonæum*; the outer *Lamella* covering its fore-part, the inner passing over its *Fundus*, and covering the hinder: It is compos'd of three Coats; the outer is a Covering of the *Peritonæum*, the middle is Muscular, and made up partly of Longitudinal, and partly of Fibres variously intersecting each other. The inner is Nervous, in which are plac'd several Glands that separate an unctuous Matter to defend it from the Acrimony of the Urine. This Coat is capable of very great Distention; but not having a Power of contracting its Dimensions as the two others have, it is therefore, when not distended, and the Bladder empty, corrugated in several Places.

THE middle Coat is plac'd by Anatomists among the Muscles, and nam'd *Detrusor Urinæ* from its Office; (*Tab. III. Fig. I.*) but it is not easy to apprehend how the Contraction of this Muscle should produce such an Effect as is commonly describ'd; since its Longitudinal Fibres having no fix'd Point whence they spring, but terminating at each End in the lower Orifice of the Bladder, they would rather pull up the Neck of it when they contract themselves than bring the *Fundus* downwards. (*Fig. I. II.*) Dr. Douglas, among his other curious Preparations of this Part, has one which gives us a *different*, but the *true* Disposition of these Longitudinal Fibres; whence he found, that they arise from the inner and lower Part of the *Os Pubis*, and the fore-part of the *Prostata*, and passing from thence over the *Fundus* of the Bladder, come down the hinder

hinder Part of it, and are inserted into the back part of this Gland: And that these Fibres are rang'd in the Manner that accurate Anatomist has described, the two annex'd Preparations plainly shew, which have been made for that Purpose since his communicating this his Discovery to me; for which I take this Opportunity publickly to return him Thanks, as well as for several others, that are well worthy Observation, and when he thinks proper to oblige the Publick with them, will appear very much to his Honour. Analogous to the *Prostata* in Women, is the *Vagina Uteri*, in which the Fibres terminate. As this Muscle is so dispos'd, we easily see that by its Contraction the *Fundus* of the *Bladder* will be pull'd forwards and downwards towards the *Os Pubis* by the Longitudinal Fibres, at the same time that the oblique ones lessen its Dimensions, and so both together will exclude the Urine.

THE *Bladder* has three Orifices; one External for the *Exit* of the Urine, and two Internal for its *Admission*, where the *Ureters* open into it. (*Fig. III.*) From each of these latter *Morgagni* has observ'd in both Sexes, that there proceeds a small but pretty thick and compact fleshy Body, which passing from the *Ureters* obliquely downwards on the Back-part of the *Bladder*, and being somewhat Protuberant within its Neck joins its Fellow, and both together make an Angle at their Juncture; from whence in Males a Line is extended downwards as far as the *Caput Gallinaginis*. These Bodies he takes to be a *Production* of the *Ureters* themselves, and with very good Reason; for by depressing them with your Fingers, the Mouths of the *Ureters* contract and are clos'd*. The *Bladder* is divided into two

* Adversar. 1. Pag. 5.

Parts, the *Fundus* and the *Neck*; the former of which is the larger Part, which rests upon the *Intestinum Rectum* in Men; but in Women upon the *Vagina Uteri*: The Neck is the smaller, which is much more contracted, and longer in Men than in that Sex. At the Bottom of this is plac'd a small Muscle of circular Fibres, call'd the *Sphincter*, which prevents the involuntary Emission of Urine.

THE Neck of the Bladder is fix'd behind to the *Rectum* in Men, in Women to the *Vagina*; and before in both to the *Os Pubis*, by Means of the *Peritonæum*. Its *Fundus* is ty'd above to the Navel by the *Urachus*, degenerated into a Ligament. But besides this Connexion to these different Parts, Dr. Bohn, a Professor of *Leipswick* near fifty Years ago, observ'd another particular Adhesion of the *Bladder*; which is, that the greater Part of the *Fundus* in human Bodies, adheres to, or is continuous on the fore-part of it to the *Peritonæum* and Muscles of the *Abdomen*; and upon this Consideration, and because this Part of the Bladder is not merely *Membranous*, but *Muscular* also throughout its whole Extent, he admonishes us not at all to despair of Wounds made in it; inasmuch as the *Muscles*, *Peritonæum* and *Bladder*, being thus continuous to each other, their Fibres will grow together, and all of them unite in one common *Cicatrix*, provided proper Care is taken in the Dressing, and the Wound not dilated with Tents, as he and the Surgeons attending observ'd in a Student about six Years before*. *Stalpart vander Wiel*, who wrote his Observations about that Time, has taken Notice of the same Thing†, and how near they both come to the Truth, our Surgeons are now

* *Oeconom. Animal. Progyrnas. 24. pag. 224.* † *Centur. 1. Observat. 83.*

sufficiently

sufficiently inform'd of, since Mr. Douglas upon much the same Principles has introduced a successful Operation for extracting the Stone out of the Bladder above the *Os Pubis*, by making an Incision into this very Part *. But to go on, the Bladder has Arteries and Veins from the *Epigastricks* and *Iliacs*, and Nerves from the two *Plexuses* in the *Pelvis*, made out of the Branches of the *Par Vagum*, and the Nerves of the *Os Sacrum*.

ADJOINING to the Neck of the Bladder is the *Urethra*, which in Men makes a Curvature of about four Inches in Length under the *Os Pubis*, and is extended underneath and between the *Corpora Cavernosa Penis* to the End of the *Glans*. Its Substance is partly spongy, and partly nervous; but as it relates to the Emission of Urine, in which Circumstance only we consider it here; we need only take Notice of its *inward* Membrane. (*Tab. IV. Fig. I.*) This is extremely soft, and of exquisite Sense. The upper Part of it is perforated in several Places by the Mouths of several small *Ducts* which lie immediately upon it, and run Lengthways; commencing about a Thumb's Breadth from the *Glans*, and ending about the Breadth of seven or eight Inches from it. These Ducts probably come from some small Glands plac'd within the Body of the *Urethra*; and the Liquor they separate is the same Colour and Consistence with that separated by Mr. Cowper's Glands, though the Use of it seems rather to defend the Cavity of the *Urethra* from the Sharpness of the Urine than to lubricate it for the freer Passage of the Seed, (which is the principal Office of the others) because the same are found in the *Urethra* of Women (over and above the *Lacuna*) where they can contribute nothing in *Coitu*.

* Lithotomia Douglassiana, *Set. 9. pag. 49.*

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THE *Urethra* is likewise furnish'd with a Muscle, which is serviceable to it as a Urinary Vessel, and call'd from its Office *Accelerator Urinae*. (Tab. IV. Fig. I.) This arises fleshy from the upper Part of the *Urethra* on both Sides as it passes under the *Ossa Pubis*, and encompassing the Bulb meets on its inferior Part; where having run along a little Way in the *Peritoneum*, it divides its self, and makes two tendinous Insertions into the Sides of the *Corpora Cavernosa Penis*.

As to the Disposition and Structure of the other Parts of this Tube, as the *Corpora Cavernosa*, the *Glandulae Mucosae* of Mr. Cowper*, the *Lacuna* of De Graaf†, &c. they relate to it as it is an Instrument of Generation, and not as a Conduit-pipe to the Urine, and are therefore foreign to the Subject in Hand: We shall only take Notice in general, that it has Arteries and Veins from the *Hypogastricks*, and in Women from the *Pudenda*, and is furnish'd with Nerves from those of the *Os Sacrum*.

BEFORE we finish this Section, it will be proper to take Notice of the *Glandulae Renales*; because most Anatomists have fancy'd that they contribute something to the Kidneys in performing their Office: for they are situate so near each other, that the Membranes which invest them both externally are connected very fast together, and in a *Fetus* near as big as the Kidneys themselves, but they do not increase in Proportion with other Parts. Within they have a pretty large *Sinus*, which the late Dr. Tyson, by blowing into, found to empty themselves into two Veins; whereof the Right pass'd imme-

* Philosophical Transactions, N°. 258.
Organis, cap. 6. pag. 163.

† De Mulier.

diately

diately into the *Cava*, the Left into the *Emulgent* *. They have Arteries from the *Emulgents*, sometimes from the *Aorta* itself, but their *Excretory Ducts* could never be found, and therefore the Use of these Glands has not been ascertain'd, till very lately *Valsalva* observ'd them, which he says descend to the *Testicles* in Men; but in Women are sent to the *Ovaria*, and are therefore instrumental in Generation †: This has put several upon inspecting these Bodies more narrowly, but to no Purpose, for none such appear'd. However Mr. *Ranby* has discover'd, instead of them, two *Spermatic Arteries* never taken Notice of before, which very probably are what *Valsalva* took for *Excretory Ducts* ‡; for the Description of the Disposition and Progress of both are very much alike; and we all know, that the smaller Arteries in dead Bodies, appear white like those Vessels. These Arteries are near as big as the Seminal. That on the right springs from the *Aorta*, about a Finger's Breadth above the Seminal, first sending off a large Branch to the *Glandula Renalis*, and then another, which being enclos'd in the same common *Capsula* with the *Spermatick Artery* and *Vein*, descends along with them to the *Testicle*. That on the Left is propagated in the same Manner, only sometimes it arises from the *Aorta*, sometimes from the *Emulgent*. But notwithstanding this Discovery, we are still as much at a Loss for the Use of these Glands as ever: For though these Arteries distribute a Branch both to them and the *Testicles*, yet there is nothing communicated from one to the other upon that Account; and that they separate a Liquor for diluting the venal Blood, which is too thick after its being robb'd of its aqueous Parts by the Filter of the Kidneys, as is the Opi-

* *Philosophical Transactions*, N°. 142.

† *Id.* N°. 385.

‡ *Id.* N°. 387.

nion of some, does not appear altogether rational ; for if this was their Office, why are they so very large in a *Fetus* where there is so little Urine secreted ? What *Morgagni* hints upon this Subject appears much more probable ; that they are *Lymphaticks Glands*, and of the same Nature with those placed near the *Receptaculum Chyli*, and the Beginning of the *Thoracick Duct* : Namely, continually to pour forth a Liquor through their *Lymphatick Vessels*, in order either to dilute the *Chyle*, or to keep open and lubricate the Passages ; and this may agree with their extraordinary Bulk in *Fetuses*, since in them there is either no *Chyle*, and therefore a greater Quantity of *Lymph* is necessary to keep these *Vie Lactea* open : Or if there is, it is in so small a Quantity, and at the same time not acted upon by the *Diaphragm*, that more *Lymph* is required to carry it through these Ducts into the *Subclavian Vein*.*

I HAVE now gone through the Anatomy of the Parts ; in which I have taken Notice of every late Discovery that is confirm'd by Inspection, and which don't commonly occur in Authors. Some may reckon these among the *Minutiae* of Anatomy ; but then these *Minutiae* are not only the immediate Instruments of Action, but also the latent *Niduses* of the grand Distempers incident to these Parts. The searching these out therefore cannot be useless, as they will lead us to the Knowledge of the Powers peculiar to each, and to the *Rise* and *Nature* of these Distempers themselves, which I hope will appear in the Sequel of this Lecture.

* Adversar. 3°. Animadvers. 31. p. 66.



SECTION II.

Of the Uses and Powers of the Urinary Organs.

WE come now to inquire into the Uses of the Organs described, and into the Powers with which they respectively act upon the Fluids that pass through their Cavities. That the general Use of them is to separate the Urine from the Blood, and to promote its Passage afterwards out of the Body, appears *primâ facie*, upon dissecting these several Parts: But the Manner how this Separation is perform'd has been very little understood by all the ancient Writers, as well as by many of the more modern ones, which has occasion'd this Action to be attributed to different Causes. As, that the Urine was secreted from the Blood by means of *Digestion* *; that the aqueous *Serum* was *precipitated* from the *Cruor* by a peculiar *Ferment* residing in the Kidneys †; that the Blood was dispos'd to part with its Serosity by a Ferment that put it into *Fusion* ‡, and that the Kidneys separated the aqueous Parts from the rest by an *attractive* Power inherent in their Substance §: The bare Recital of which in this Age is sufficient to shew, that they have no Existence in this Part of the Animal Œconomy.

* Van Helmont.

† Sylvii Praxis Med. lib. 1. cap. 55.

Du Hamel de Affect. Corpor. lib. 2. cap. 3. ‡ Willis. Pharmaceut. Part. 1. Sect. 4. cap. 3.

§ Galen de usu Part. lib. 5. cap. 6, & 7.

It will not however be amiss, before we explain the Nature of this Secretion, to premise, that *Bellini* and *Professor Boerhaave*, though both of them reject these Hypotheses, have notwithstanding fallen into a Mistake about this Affair; for the first imagines, that the Blood, when arriv'd at the Extremities of the Emulgent Arteries, is *extravasated* thro' their patent Orifices into a *small Space* that lays between them, and the Origination of the *Tubuli Urinarii* and emulgent Veins; the former receiving the urinous Parts, the latter the reflux Blood by means of the *different Configuration* of their Orifices: Whereas it is not only evident to Sense, from *injecting* the Kidney, that the urinary Ducts spring *immediately* from the extreme Branches of the Artery; but it is demonstrable likewise from the Nature of Fluids, that the Orifices of these Vessels cannot be different in Figure; because the Pressure of all Liquors being constantly perpendicular to the Sides of the containing Vessels, these will hereby be every where distended equally, that is, they must be Circular*.

THE Blood indeed is previously dispos'd for a particular Secretion by the peculiar Attrition of its Parts, and the Pressure it undergoes in the various Complications and Contortions of the *Arteriole* of the Gland; whereby it is determin'd to part with such Particles as are adapted to the Orifices of the secreting Canals, which will be imping'd upon them with a certain Velocity; and as these Complications and Contortions are vastly different in different Glands, there will hence arise a Variety of Secretions in these Bodies: But that the Orifices of the Secretory Ducts must be *Circular*, (though their Dimensions differ in different Glands) is evident

* *Bellini de Structurâ Renum*, pag. 23.

from the necessary Effects of Fluids upon yielding Vessels, as they run through them. And by the Way, the whole Doctrine of Secretion depends upon the *particular Contexture and Disposition* of the Arterial Branches of the Gland, the Velocity with which the Blood is imping'd upon the Orifices of the separating Canals, and the *Diameters* of the Orifices themselves.

THE *last Author* has err'd, by concluding, that the Secretion of the Urine is perform'd two Ways; the one more simple, by the immediate Percolation of the urinous Parts through the *Bellinian Ducts*; the other more complex'd, by the Assistance of *distinct Glands*: Whereas there are no such Bodies, in his Sense of that Word, to be found in the Kidneys*.

THE Separation of this Liquor then from the Blood is perform'd by a very simple Piece of Mechanism, arising only from the Structure of the Kidneys, and some Properties of the Blood circulating through them. For from the Description of the constituent Parts of these Organs already given, it appears, that the Blood by the Force of the Heart is propell'd through the various Ramifications and Convolutions of the Emulgent Arteries, till it comes to the Orifices of the *Bellinian Ducts*, which are the separating Canals; but these not being capable, from the Smallness of their Diameters, of admitting the whole heterogeneous Mass, but only such Parts of it as are proportionate to them, these only will be receiv'd, whilst the grosser Compound will circulate through the more patent Originations of the *Emulgent Veins*, to be return'd by them into the *Vena Cava*. Now the aque-

* Boerhavei Institut. N° 353.

ous Part of the Blood consisting of much the smallest Particles of it, and the *Salts* of the Blood having a close Union with the watery Part, as being dissolv'd in it, these will first pass through the Orifices of the Secretory Vessels, and the secern'd Fluid will consequently for the most Part consist of these Principles; which that the Urine does, will presently appear.

THE Urine thus separated, flows through these Ducts to the *Papillæ*, and is discharg'd by them into the *Fistulæ Membranaceæ*, which convey it to the *Pelvis*. This Cavity, though different from what Nature practises in other glandulous Parts, the Excretory Ducts of such generally terminating in one large common Duct without any Cavity interposed, yet is absolutely necessary from the *Figure* of the Kidney; for this making a considerable Segment of a Circle, in which the urinary Tubes are propagated in great Numbers from the Circumference towards the Centre, if they had open'd there at once in a Duct of a *small* Diameter, their Orifices would have been brought so close to one another, and with Directions so opposite, as necessarily to have hinder'd several of them from discharging their Contents, or at best have render'd such Discharge very irregular; which is prevented by this *Basin*, whereby their Orifices are remov'd farther from the Centre and one another, and the Discharge rendered thereby equal and uniform.

FROM hence the Urine descends through the *Ureters* into the *Bladder*; but whether by its own Gravity, or whether it is forwarded in its Course by the Action of these Tubes, has not yet been determined. Some * Anatomists of great Note have in-

* Verheyen Anatom. Tractat. 2. cap. 18: Dionis Anatom. Demonstrat. 3. ferr'd.

ferr'd, from the Substance and Disposition of their investing Coats, that they are not merely passive, and barely afford a Passage to the Urine, but that they are endu'd with a Sort of *Peristaltick* Motion, which promotes its Descent into the Bladder. In Brutes indeed this Action of the *Ureters* seems somewhat needful, by Reason of the Horizontal Situation of their Bodies, the Urine not flowing downwards as in Men, and consequently its Weight contributing little or nothing to its Motion; but in Men there is no such Necessity for this Action, because the Urine will descend of Course from the erect Position of these Tubes. On the other Hand, I am apt to think, that the Course of the Urine in us rather requires a Check than a Spur, in order to prevent its coming too violently into the Bladder, which would create an uneasy Sensation; and that for this Reason Nature has made the *Ureters* of *unequal* Dimensions in different Parts of them, and has remarkably *contracted* their Orifices at their opening into the Bladder, that they might be so many Impediments to any sudden Influx. But besides this Consideration, it is still more probable that they want this Power, because these Tubes, contrary to all other Parts that have muscular Fibres, when once they are forcibly distended, never resume their former Dimensions, as is observ'd in hard Drinkers, and in Nephritick Cases*, which they would do if they enjoy'd a peristaltick Motion. But to proceed,

THE Urine is receiv'd from the *Ureters* by the *Bladder*, and is prevented from regurgitating into them by the Contraction of their Orifices, and the Obliquity of their Insertion. Here it remains, till by its Quantity and Acrimony it distends and sti-

* Ruysch. Thesaur. N° 8. pag. 13.

mulates its inmost Coat, which causes the muscular Coat to contract its Fibres, and act strongly upon it; the two *Corpora Carnosa* of *Morgagni* shortening their Fibres at the same time, and so straitening the Orifices of the *Ureters* that none should escape that Way. By this Pressure, and that of the *Abdominal Muscles*, the Urine is protruded downwards with a Force sufficient to overcome the *Sphincter* of the Bladder, and to carry it through the *Urethra* some Distance from the Body. But lest any part of it should stay in this *Tube*, when the Pressure ceases and the *Sphincter* is clos'd, the *Accelerator Muscle* begins to act, which expels any Remains that lodge therein.

THE Force with which the Bladder acts in projecting the Urine has been attempted to be fix'd by two speculative Mathematicians: But their Calculations are widely different; the one making it amount to an *uncommon Weight*, whilst the other reduces it to a *Trifle*.

THE late ingenious Dr. *Keil* has computed it, exclusive of the * *Abdominal Muscles*, to be equal to no more than *three Ounces*; which seems too inconsiderable to overcome the Contranitency of the *Sphincter*, and at the same Time project the Urine six Foot from the Body in a Horizontal Direction; for the *Abdominal Muscles* contribute very little, except when we hold our Breath and strain, and then indeed they force strongly downwards and press upon the Bladder. But this Calculation is very defective: For not to mention what *Michelotti* has observ'd, that Dr. *Keil* has not at all taken Notice of the *Vis Compressionis* innate to all Parts of the Bladder's *internal Superficies*, but only to that Part

* *Keil's Essays*, pag. 91.

of it which answers to a *transverse Section* of the *Urebra*, it is farther deficient, in that he has omitted to consider the *Length* of the *Urebra* from the Orifice of the Bladder, and the *Friction* arising therefrom, which he ought to have done to make it more perfect; for though the Force that causes a Fluid to run out at an *Orifice* with a certain Velocity, is as he has laid down; yet if there is a *Tube* extended *any Distance* from it, through which the Fluid must pass afterwards, the Velocity of it at its coming out at the *End* of this *Tube* will be, *ceteris paribus*, as its *Length*; and a greater Force will be requir'd, for Example, to move a Fluid with a given Velocity through a *Tube* of *twelve* Inches long, than through one of *four* and of the same Diameter. This will raise the *Power* of the Bladder somewhat higher; but will scarcely yet be sufficient to throw the Urine so far from the Body.

MICHELOTTI on the other Hand*, from *mechanical* Deductions raises the Power of the Bladder to 504 lb. Weight, but then the *Principle* he sets out upon is *false*; for he lays down, that the Force by which a Fluid running out at the Orifice of any Canal acquires a certain Velocity, is equal to the Weight of a Cylinder of the same Fluid, whose Basis corresponds to the Orifice it flows through, and whose Altitude is equal to the *simple Altitude* of the extreme Superficies of the Fluid above it; whereas it has been *demonstrated* by Sir Isaac Newton†, that *this Force* must amount to that of a Cylinder of the same Basis, but of *double* the Height, from whence any heavy Body must fall to gain such a Velocity. However, what he deduces from the *Principle* he lays down is just; and if he had

* De Separatione Fluidorum, pag. 117. & seq.
sophiæ Principia, Lib. 2. Prop. 36. Corollar. 2.

† Philo-

proceeded in the same Manner upon Sir *Isaac Newton's*, as he has upon *his own*, he would have come as near as possible to the entire Force of this Organ. The *whole Proposition*, with what he draws from it, is much too long to be transcrib'd into a Discourse of this kind: I shall therefore refer you to the *Work* itself; and only observe, that from hence may be seen the Uncertainty even of *mechanical Reasoning*, when apply'd to explain *some Powers* in the Animal *OEconomy*; though it is the *best* we can make Use of in this Part of Learning.

FROM this cursory View of the Actions of the respective Parts, and of the Nature of the Urinous Secretion, may be drawn some *Conclusions*, which will serve as so many Answers to several Queries that commonly occur among the Writers of *Institutions*: For from hence we learn, that the Urine is not an Excrement of any *particular* Concoction, as the Antients term it, but that all the Digestions supply Matter for it; because whatever is brought to the Kidneys has undergone the Action of the *Stomach*, has been broken and divided in its Passage through the *Lungs* by the Force of Respiration, and from thence flows blended with the *nutritious* Part of the Blood, till it is separated from it by the Orifices of the Urinary Tubes; and consequently is an Excrement of *all* the Concoctions.

HENCE likewise we can account why we urine so frequently when we drink plentifully; and particularly why this Excrement is secern'd in so *short* a time, and in such *large* Quantities, after taking Diuretick Liquors upon an empty Stomach, without having recourse to any *occult* Passages from this Organ to the Bladder, which Anatomy has never shewn, and which repeated Observations have proved to have no Existence. For notwithstanding an
Expe-

Experiment printed in the *Philosophical Transactions* somewhat favours this Notion, a pretty Quantity of Urine being found in a Dog's Bladder, though the *Ureters* were ty'd, and were also a little swell'd above the *Ligature*, yet on the other Hand, upon opening the Bladders of Persons dead of a Suppression of Urine from an Obstruction of the common Passages of the *Kidneys* and *Ureters*, there never was found a Drop of Urine in them. *

NEITHER indeed is there any occasion for a shorter Conveyance than what Nature has made *apparent*; for as to the frequent Emissions during the time of Drinking, it is to be observ'd, that before this happens, the *Stomach*, the *smaller Intestines*, and the *Lacteal Veins* are replete with the Potables, so that the Blood receives a fresh Supply of a Fluid from the next Draught that is taken down, which, if I may so call it, protrudes what is already contain'd in the Vessels above-mention'd into the *Subclavian Vein*: The Consequence of which will be, that a greater Quantity of Blood will be brought to the *Kidneys* than usual, and therefore more Urine separated; and so much the more, the more frequent the Draughts are repeated. And this is the Reason why the first Urine that is voided is of a higher Colour, and bears the Tokens of Concoction; whereas the subsequent Emissions lose these Signs, and the Urine at length flows perfectly limpid and crude, which it will continue to do till this extraordinary Supply has quite passed off, and then it will reassume its former Colour, &c.

As to the other Case, where the *Stomach* is empty, and the Blood is supposed to be divested of the Urinous Matter in great Measure, if we attend

* *Philosoph. Transact.* N° 65, 67.

to the Time which Fluids take up in passing from the Stomach into the Blood, and how soon afterwards they are carried to the Kidneys by the Rapidity of its Circulation, we shall find the common Passages altogether sufficient.

It must be consider'd then, that though *solid* Substances require a good deal of Time to be comminuted by the Stomach, in order to have their Parts render'd small enough to enter the Lacteals, yet *Fluids* when taken alone, from the Minuteness of their Particles are naturally fit to pass through them, and from their Aptitude to Motion will yield to the first Impression; for which Reason they will make no Stay there, but very soon be protruded by the Action of the Stomach and Guts into *these Vessels*: And that the Progress of Fluids through *them* takes up but a very short Time, is demonstrated from the almost instantaneous Depletion of the *Lacteals* in living Animals, that have been open'd for this Purpose some time after a full Meal, when the *Chyle* has been flowing through them; so that if that Part of the Liquids which comes away by Urine is not longer in flowing through the *Heart* to the *Orifices* of the Urinary Ducts of the Kidneys, than the same is in passing from the *Stomach* to the *Heart*, the *common* Channels will be found every Way to answer these Emergencies.

Now, as the *Heart* throws out every *Systole* one *Ounce* of Blood, and beats *sixty Systoles* in a Minute, there will pass into the *Aorta* 900 Ounces in a Quarter of an Hour: Taking therefore the Dimensions of the *emulgent Arteries*, which spring immediately from its Trunk, to be *one Tenth* of that of the *Aorta*, (which is very near the Matter,) the Quantity of *Blood* passing through *them* in that Time will be *ninety Ounces*, or *seven Pounds six Ounces*

Ounces Troy. Add to this, that the *Serum* makes up the greater Part of the Blood, and at this Time is in a much larger Proportion, from the Addition of the ingested Liquor, and we may conclude reasonably, that two or three *Pints* of Urine may be secreted from such a Quantity of Blood in that time, and great Part of it much sooner; which will answer every Thing that has been observ'd, as to the quick Passage of *Diureticks*; the Effects of which upon this Secretion, either as to its Quantity or Quality, being at the soonest more than half this Time.

THIS Notion of an immediate Passage from the Stomach to the Bladder, so contrary to Anatomy and the Nature of the Animal OEconomy, one would imagine should have been exploded at the first Dissection of an human Body; much more now, when these Parts are so accurately known: but it seems it is again reviv'd and strenuously argued for*, which is the Reason for inserting the foregoing Paragraphs. But to proceed,

As a *Corollary* to the foregoing it may be laid down, that the Quantity of Urine ought to be proportionate to the Quantity we drink. For, *ceteris paribus*, the Quantity of the secern'd Fluid is in Proportion to the Quantity of Blood brought to the Orifice of the separating Canal; but the Quantity of the *aqueous* Part of the Blood, of which the Urine chiefly consists, is in Proportion to the ingested Liquors; therefore the Quantity of Urine will be in Proportion to them likewise. But here some Allowance must be made for what passes off by *Perspiration* and *Sweat*, in *Expiration*, and with the *Saliva*; as likewise for different Circumstances.

* Morgan's Principles of Physick, Lond. 1725.

For Example, from Heat or Exercise, the *aqueous* Parts of the Blood passing through the Pores of the Skin in Sweat, the Quantity of Urine will be less; as on the contrary, the Pores of the Skin being stopp'd by Cold, a larger Portion than usual will be voided.

As the last Inference from the foregoing Theory, it appears, that *other Particles* besides what naturally compose the Urine, though of *unequal* Surfaces, one of which too may be longer than the Diameter of the Secretory Canal, may nevertheless be separated together with it, provided the Surface that presents itself to the Orifice does not exceed its Diameter. And that *Blood* itself may pass through, if it is imping'd with a Force sufficient to distend and enlarge the Secretory Ducts; analogous to what happens to some other Vessels that are naturally smaller, but amplified for a Time, as in critical and symptomatical *Hæmorrhages*, and in the *Menstrua*.

THE Doctrine laid down is so well establish'd upon the *mechanical* Properties of the Parts concern'd, that it is scarce liable to any Objection. The main one which seems to affect it is this: That seeing all the Parts that constitute the Urine are in the Blood when it is brought to the Orifices of the Urinary Ducts, if the Percolation of these from the rest only depended on *their Diameters*, they would all be secern'd at the same Time, being of the same Nature and adapted to them, which is contrary to *Fact*; the resluent Blood found in the Emulgent Veins being still possessed of some of the Principles of the Urine. But if we consider that part of the Blood is spent upon the *Nourishment* of the Kidneys, and does not come to these Orifices, but is immediately received by the Venal Branches that correspond

respond to them, we shall find the Reason why it still retains these Principles in some Degree, (which by the Way may be separated from it in some subsequent Circulation through these Organs) and at the same Time see this Objection obviated.

WE come now to consider the Nature and Properties of the Urine *itself*; this consists of a *fluid* Substance, in which are sustained several dense and *solid* Particles. The elementary, or more simple Parts of it, are *Water*, *Salt*, and *Earth*, which are manifested to the Senses in the Experiments of *Bellini* *.

THAT simple Water is the *fluid* Part of the Urine, almost wholly, is known from a gentle Evaporation of it; by which Means what is exhal'd is found to be limpid and insipid as the purest Water, and the inspissated *Residuum* after the Evaporation is over, is in all Respects restor'd to the State of true Urine again; that is, in Colour, Taste, Smell and Consistence, by pouring the same Quantity of common Water upon it, instead of the Fluid that was evaporated.

THE Existence of a Salt is prov'd by the Taste, which becomes more pungent, the more the *aqueous Menstruum* is exhal'd, till at length there is left a black viscid Substance that liquifies in the Air like common Salt, and is so poignant as scarce to be borne by the Tongue. The Nature of this essential Salt has not been consider'd by this Author; but by Experiments we find, that it is not a pure *Alkali* as some Chymists have imagined, neither is it an Acid, but is *sui generis*, and partakes of both Qualities. For if you pour Spirit of *Nitre*, *Aqua-*

* Bellini de Urinis, pag. 9.

fortis, or the like *Acid* upon the Urine, they will only produce a somewhat *bigger* Colour in it; which *acid* Spirits, when mix'd with either a fix'd or volatile *Alkali*, always occasion a *considerable Ebullition*. So if you put a *nitrous* Salt into the Spirit of Urine, it will turn it *milky*; and the like will happen if you do the same with *Salt of Tartar*; which Experiments plainly prove this Salt to have both *Acid* and *Alkali* in its Composition. But to proceed,

THE Particles of *Earth* in the Urine are perceiv'd by the following one: If you evaporate the Urine till it comes to the Consistence of Honey, and pour upon it the same Quantity of common Water, the artificial Urine will have this in common with the Natural; that it will grow turbid and putrify, and before its Putrification, will let fall a perfectly insipid, subpallid and impalpable Powder every way agreeing with Elementary Earth.

THAT there is a *Sulphur* also in the Urine, tho' overlook'd by *Bellini*, is evident from the strong Smell it has when only voided; but chiefly from that Foetidness arising from it, when it is in a State of Putrification, or during Evaporation; though there is indeed but a small Quantity of this Principle, because there is scarce any of it comes off in Distillation.

UPON these three Principles of Water, Salt, and Earth, and the different Proportions they bear to each other, depend in great Measure the *Colour*, *Saltiness*, and *Consistence* of the Urine, with all the Varieties observable in each. If the aqueous Parts more than ordinary exceed the other, the Urine will be limpid or pale: If the Salts abound too plentifully, it will be of a shining flammeous Colour, but still clear; the Salts being pellucid Bodies.

dies. If the Earth prevails, being an Opake Body, it will obstruct the Passage of the Rays of Light, and produce a more intense Colour, taking off from the Clearness and Pellucidness of the Urine, and the more so as its Quantity encreases in an Overproportion, till at Length the Urine will be turbid and thick.

BUT besides these three, it is reasonable to think, that the natural Colour of the Urine is owing in great Measure to the *Sulphur* contain'd in it. For though the Quantity is but small, yet it still retains its Colour after it is separated from the other Principles, and will give a considerable Tincture to Water, when mix'd with it, which the other Principles of Salt and Earth will not do after their Separation, and yet *they* are allow'd on all Hands to contribute chiefly to its Colour.

THE different Degrees of *Saltiness* in the Urine arise from the different Quantities of Salt floating in the aqueous *Menstruum*; whose Pungency upon the Tongue will be greater, the less Fluid there is to dissolve them and obtund their *Spiculæ*, and so *vice versâ*. And that the Urine will be of a *grosser* or *thinner* Consistence, as the solid Particles are in a greater or lesser Degree, is so evident, that it wants no Explanation.

THE *Contents* observable in the Urine, which bear the Names of *Nubeculæ*, *Suspensiones* and *Sedimenta*, are nothing else but these solid Particles; which when this compound Fluid is out of the Body and at *rest*, separate from the aqueous Part, and take Place according to their specifick Gravities; having these Appellations given them as they are found in the upper, middle, or lowest Part of the Urine: But so nevertheless, that the different Den-

sity of these *Contents* at one time more than another, and the different Resistance of the Medium in which they are suspended, may afterwards alter their Situation; insomuch that what was at first a *Suspension*, may at length subside and become a *Sediment*.

THE Nature of the Urine being thus known, we may draw several Inferences from it that will explain some Affections common to the Animal Œconomy. Hence first the Reason appears, why upon using Exercise, and in hot Weather, the Urine is of a higher Colour, and more salt and stimulating than at other times: And why the like Urine is made, after having abstain'd some time from taking any Liquid. For in both Cases the solid Contents will be in a greater Proportion than the aqueous *Menstruum*; this last being carried off through the Pores of the Skin in the first Instance, as in the second a fresh Supply of it being for some Time taken off from the Blood, what is secreted by the Kidneys in such Circumstances will be more than ordinarily saturated with these solid Principles.

THE foregoing Observation shews the Cause, which makes the Urine of healthy People and of a strong Habit of Body, to have seldom the *Nubeculae* and *Suspensiones* found in it, but the *Sediment* more frequently; because the two first consisting of the more fine and subtile Parts of the solid Contents, pass off together with the aqueous by Sweat and Perspiration, which the more gross and heavy Particles that form the *Sediment* can't do, by Reason of their Bulk and Figure, and therefore will be secreted by the Kidneys, and subside by their own Gravity. The same shews the near Relation between the *Urine* and *Sweat*; and that the Increase of the last may supply the Defect of the Urinous Secretion

Secretion in some Measure; which is the Reason that Patients linger so long under a total Suppression of Urine from a Stoppage in the Kidneys, before this Ailment kills them; which sometimes in strong Bodies is *eighteen* or *twenty Days*: And there are several Instances where the Urine has been totally suppressed from the same Cause for *fifteen* and *sixteen* Days together, and yet the Patients *recover'd*.*

To determine the exact *Colour* and *Consistence* the Urine ought to have in healthy Persons is almost impossible, by Reason of the great Latitude that must be allow'd for the Difference of *Age*, *Constitution*, and *Diet* of different Persons, and of these in the same at different Times. But seeing the two Extremes of a limpid Urine, and of a red and turbid one, are produc'd as either the watery *Menstruum* or the solid Contents abound beyond Measure, we may venture to conclude thus far, that from a due Portion and Mixture of these in a state of perfect Health, there should arise a *Medium* between these Extremes, which is a light *yellow*, or *Citrine* Colour. As to its *Consistence*, regard being had to the foregoing Circumstances, it should be pretty near that of common Water, but somewhat more thick and heavy, by Reason of the solid Principles contain'd in it.

WHY the natural *Sediments* should be white, light and equal, is more easily accounted for. For seeing the Fluids secreted from the Blood, will be as the State of the Blood at the Time of their Secretion; and the Blood in a natural State is suppos'd always to be alike and equal to itself, whatsoever Parts of it are separated by the Kidneys in equal Times, will also be alike and equal; and con-

* Stalpart. Observat. Centur. 1. Observat. 51.

sequently when out of the Body and at rest, will mutually take Place by one another, and render the *Sediment* equal. The *Whiteness* of it is owing to the large Quantity of *Salts* contain'd in it (as is manifest from the *Bellinian* Experiment) * which being united with the thick viscid Parts of the Urine, will subside along with them, and by the *Rules of Opticks* produce such a Colour.

Hence in the last Place we may know, how far the Inspection of the Urine is *useful* in the Practice of Physick: For by comparing the several Appearances in the Urine of *diseased* Persons, with those that *naturally* arise in it, and observing in what Respects they differ from each other, we shall be inform'd in great Measure of the present State of the Blood, as to the Mixture of its Parts, and the Proportion between them. And if we take Notice at the same Time of all the Symptoms that *accompany* such Appearances, and *follow* upon them, we shall discover what the Distemper is that proceeds from such a *Crafsis* of Blood, and also prognosticate the Event of it.

IT were easy to shew from Authors and private Observation what State of Blood each Alteration of the Urine discovers: But being confin'd to treat only of the Distempers belonging to some particular Organs, it will be impertinent to take Notice of any other, than what will lead us to the Knowledge of these; which will be seen in the remaining Part of this Lecture.

WE have now gone through the *Uses* of the *Parts*, and enquir'd into the *Nature* of the *Urine*; in which last I have for the most part follow'd

* De Urinis, pag. 13.

Bellini in the most concise Manner possible, as his Account of it is the best, both by his *Experiments*, and the *Conclusions* he draws from them. And as the *latter* are here prov'd by different Mediums from what he himself made use of, they so far make them bid fairer for Truth.



SECT.



S E C T. III. P A R T I.

Of a STONE in the KIDNEYS.

THE *Organs of Urine* are incident to several Indispositions, in common with other Parts of the like Structure and Composition, and which spring also from the same general Causes; as *Inflammations, Tumours, Abscesses, Ulcers, Schirri, &c.* but the most frequent, and indeed chief Distempers that afflict them, proceed from the Urine separated by them, or passing through them. These are attended with very untoward Symptoms, and if of long Continuance, very fatal Consequences: None of which are more common than those arising from a *Stone* in the *Kidneys* or *Bladder*; which shall therefore be the Subject of the remaining Part of this *Lecture*.

IF we compare what has been said in the foregoing Part of it, concerning the Elementary Principles of the Urine, with several Experiments made upon these concreted Substances, it will appear, that the material Cause of a *Stone* in the *Kidney* is originally in the natural Composition of this Fluid: For we find from Chymistry and microscopical Observations, that what we call a *Stone* almost entirely consists of a volatile and fix'd *Salt*, such as the Urine plentifully abounds with. In order therefore to form a calculous Concretion, there is no *Petrefaction* required, as the Naturalists term it,
nor

nor any change of Substance in the constituent Parts of the Urine, but only a Separation of the saline and some earthy Particles of it from the Fluid, and such an intimate Cohesion of these solid Corpuscles thereupon, as not to be disunited or dissolv'd again by any subsequent Afflux of Urine upon them.

BOTH these Accidents will happen, if either the Salts are in such great Abundance in the Urine, that they cannot pass through the exceeding small Ducts that form the Papilla; or if they are hinder'd from moving through them by any viscid Matter that is separated along with them, and so unites them together; or if these Ducts themselves are so much compressed or contracted, as not to admit the Salts through their Cavities. For in all these Circumstances the saline Lympha will stagnate at the Papilla, whereby the Salts will be brought too near one another; which being Corpuscles of very great attractive Powers, they will be more strongly attracted by each other than by the Fluid in which they are suspended, and consequently will separate from it, and unite in one solid Substance.

THAT any of these three Causes may singly produce such a Concrete, if they exist in the Degree laid down, is prov'd from the Nature of Salts in general, when in Fluore, and the Consequences that must follow from their being brought too much within the Sphere of each others Activity; more particularly from the Nature of those, of which the Stone consists; which are so very attractive, that even when a Calculus is reduced to a Caput Mortuum, and beat into an impalpable Powder, so that it will dissolve in Water, yet in a short time the Salts will separate from it, and coagulate so strongly,

that though the Water is heated never so intensely, they will not dissolve in it again.

HOWEVER, it is reasonable to think, that a *Nucleus* of a firm Consistence is seldom form'd by the first or second Cause, without the Concurrence of the last; as on the other Hand, that the last alone will produce one. For though there should be an over large Quantity of Salts in the Urine, or if an usual Quantity should be envelop'd in a viscid Matter, yet if the *urinary Ducts* are of a natural Dimension, they would not stagnate at the *Papilla*, unless these Qualities were in a very great Degree; but would be protruded through their Orifices by the Force and Weight of the next Urine flowing upon them; whereas if these Ducts should be much contracted, even a natural Proportion of Salts would stagnate there. And I think it is plainly prov'd, that a *Nucleus* is form'd more from the Fault of the *Kidney* itself, than from the Qualities of the Urine; in that *one* *Kidney* only is generally affected, whilst the other remains free. For if the Fault lay as much in the Urine, they would *both* be affected alike, the Urine separated by *both* *Kidneys* necessarily partaking of the same Qualities. However, that the two first are concomitant Causes, and very much contribute towards the Generation of a *Stone* is highly probable; and it is almost certain, that a fabulous Sediment, or what is call'd the *Gravel*, may owe its Origin to either of these Causes singly.

As a farther Confirmation of the Truth of what has been laid down, it were easy to shew, that the antecedent Causes of a Nephritick Fit introduce one or both of these Qualities in the Urine, or affect the Passages of the *Kidneys* in the Manner just mention'd; but as it will be troubling you with frequent

quent Repetitions of the same Way of Reasoning, to explain how each in particular operates towards producing one or more of these Effects, I shall mention the chief and most common precatartick Causes, which are comprehended in the following Observation; viz. that those Persons who make *spirituous Liquors* their constant Drink, and use them too plentifully; or those who have *weak Stomachs*, or live upon Food that abounds with *viscid Juices*; or those who altogether lead an *unactive and sedentary Life*, are, above all others, most afflicted with this Distemper. And that the Urine of such Persons must necessarily be over-stock'd with Salts, or with a tenacious viscid Matter, or that the Channels of the *Kidneys* will be too much straitned or compress'd according as either of these Causes prevail, will appear upon Examination.

1st. In the first Part of this Observation it is to be taken Notice of, that all *spirituous Liquors* abound plentifully with Salts; a Spirit being nothing else but a large Quantity of these Substances suspended in a little Water and Oil; whence from frequent drinking these Liquors the Blood will be over-stock'd with this *Principle*. But besides this, from an habitual Use of them, in Process of Time, the *Serum*, which is the most aqueous Part of the Blood, will contain a large Portion of a spirituous Fluid; and we know from Experiments, that a urinous Salt will not dissolve in such a *Menstruum*: Upon which Account the Quantity of Salts brought into the Blood with our Food will be daily increas'd. Now the Urine being separated principally and immediately from the *Serum*, which is over-salt upon a double Account, must likewise from the Nature of its Secretion be over-salt too.

HENCE we can account why the Fits of the *Stone* are not so severe in Women as in Men; they

generally drinking less Wine, and feeding less upon such gross Meats as abound with Salts. And for the same Reason we may conclude, that the Exemption those Persons enjoy from this Distemper, who only drink Malt Liquors, is owing a great deal to the lesser Quantity of Salts in these Potables, than in Wine.

2^{dly}. As an over-salt Urine is the Consequence of the foregoing Cause, so from a *bad Digestion* and *viscid Food* the Urine will be slimy and roapy. For the Aliment being too viscid, or not sufficiently comminuted in the Stomach, the Chyle will be more than ordinary viscid, which being constantly sent into the Blood, will render that in some time of the same Nature. But over and above this, the Salts which are the most incorruptible Part of our Food, being not thoroughly broken through the Weakness of the digestive Powers, will exist in larger Combinations than usual; and at the same time be enclos'd in a gelatinous Chyle, which will hold them together; for which Reason the Blood will not only be too viscid, but the Salts of it will not be sufficiently dissolv'd in its *Serum*; whence it follows from the same Reasoning as in the former, that the Urine must be likewise too viscid, and its Salts brought too near one another, which will occasion them to cohere. From hence it appears, that *Galen* did not altogether err, when he attributed the material Cause of a *Stone* to a thick, slimy, and tenacious Matter*, notwithstanding his Notion has been rejected by several modern Writers: Since being thus explain'd as a concomitant Cause, it is agreeable both to Reason and Fact.

* De Renum affect.

ACCORDINGLY we find, that Children are more tormented with the *Stone* of the *Bladder* than Adults; and especially the poorer sort of them who are generally nourish'd with Food that affords slimy and tenacious Juices. *Hippocrates* ascribes one Principle of the *Stone* in Children to bad *Milk*; which he says, being earthy and phlegmatick, will induce a Lentor into the Stomach, and when mix'd with the Sediment of the Urine in the Bladder cohere and become solid*; much more then will the same Consequences follow from *Cheese*, *Fish*, and the other coarser Diet of the Poor; and there has been no better Reason assign'd, why such young Subjects being once cut, seldom require the Operation a second Time, than that as they grow up, their Diet is either alter'd, or the digestive Powers encrease, and the Solids become stronger, whereby the Aliment will be more intimately divided, and any viscus Matter or Combination of Salts be broken by this Means, and excluded the Habit by the Force of Labour and Exercise. Agreeable to this is another Observation of *Hippocrates*† that a *Stone* is not form'd in the *Bladder* from the *Fourteenth* to the *Sixty third* Year of Age; in which Time we all know the digestive Powers are most vigorous.

3dly, How an *inactive sedentary* Life, which is the last procatactick Cause taken Notice of, should bring on a Straitness in the Urinary Passages of the Kidney, a competent Knowledge in Anatomy will inform us. This teaches us, that by a sedentary and bending Posture of the Body, not only all the *Viscera* of the *Abdomen*, but the greater Blood-Vessels themselves will be compress'd: especially the *Emulgents*, and that part of the *Aorta* and *Vena*

* Lib. de Morbis 4. Sect. 28. † Coacæ Prænotiones
Nº 512.

Cava whence they go off, as being plac'd where the Flexure is greatest. But this is not the only Consequence; for from such a Position the *Viscera* will also be forc'd backwards and downwards, and will consequently press externally upon these Vessels, so that the weighty *Viscus* of the *Liver* on one Side, and the *Spleen* on the other, will as it were squeeze the *Kidneys*, which are plac'd between them and the *Musculi Lumbares*: Upon both which Accounts, it is no Wonder if the Urinary Ducts that are continued from the Emulgent Arteries, and are by much the most yielding Substance and of the finest Contexture, should suffer most, and be so straitned as to occasion the saline *Lympha* to stagnate in them.

To this Cause it is owing, that those Tradesmen and Artificers, who sit much at their Work, are troubled with Pains in their Loins, as *Rammazzini* has observ'd*; and that Nephritick Complaints are almost entail'd upon studious Men†. And from the same Cause it comes to pass, that few People who are troubled with the *Gout* escape these Complaints at the last; for although as long as the *Kidneys* are able to do their Office, and transmit all the constituent Parts of the Urine through them, these Nephritick Symptoms will not arise (though they proceed from one common Parent) yet when the Fits of the *Gout* become frequent, and of such long Continuance, as to confine the Patient very often, and for a great while together, the Consequence will be such a Disposition of the *Kidneys* as is just describ'd, and the *Stone* will come in aid to his Destruction.

* De morbis Artificum, cap. 33. † Id. cap. 43.

MANY other Errors in the Non-naturals which are reckon'd by our Writers among the procatartick Causes of this Disease, are included in the foregoing Observation, or may be accounted for the same Way; excepting an *hereditary Disposition*, which cannot be rank'd amongst any of them, and requires a particular Explanation to its self; but this is needless formally to enter upon, since it is as easy to conceive, that Parents may communicate a particular Disposition of their Solids and Fluids to their Offspring, as that they can stamp upon them their Features, or tinge them with their Complexion.

To proceed then, a *Nucleus* thus form'd in the Urinary Tubes of the Kidney, will at length by its own Weight and that of the Urine coming upon it, be forc'd through the *Caruncula Papillares* into the *Pelvis*: Where if it makes no long stay, but is small enough to pass through the *Ureter* into the *Bladder*, it will not occasion a Nephritick Paroxysm, but only some Pain from the Roughness and Hardness of its Substance pressing against and vellicating the extreme sensible Fibres of this Tube. But if from its pointed Surface it should chance to adhere to the *Pelvis*, or from any other Accident lodge in it so long, till by the Addition of adventitious Concretions, it is render'd too big to pass through the Head of the *Ureter* without distending it, a true Nephritick Fit will be produc'd.

THIS is attended with the following *Diagnosticks*, viz. A fixed Pain in the Region of the Loins, which is propagated through the whole Length of the *Ureter*, and accompanied with a Nausea and Vomiting, a Numbness in the Thigh and Leg of the Side affected, and a Retraction of the Testicle of the same Side. The Urine about the beginning is thin, aqueous and pale, and voided in small Quantities; and if both
Kidneys

Kidneys are affected, sometimes totally suppress'd; but in the Decline of a Fit, and after the Stone has passed into the Bladder, it becomes thick and turbid, and is discharged copiously. Very often Blood flows out together with the Urine, which is many Times in so large a Quantity, as easily to discover itself; at others in so small a one, as only to tinge it of a Coffee Colour. But the most certain Diagnostick, and which is a Pathognomick Sign is, if to any of the foregoing is added a frequent Excretion of fabulous Matter, or a small Stone.

BESIDES the Diagnosticks now cited, for the Knowledge of which the World stands indebted to *Hippocrates**, there is another taken Notice of by him, which although when alone does not particularly indicate a Stone in this Part, yet together with some of the former, will assist us in making a right Judgment of the Distemper. This is contain'd in one of his Aphorisms, and is certainly above a Nurse's Observation (though we have been lately told the contrary) *let her be never so old or experienc'd.* He lays it down as a Maxim, that when Bubbles swim upon the Surface of the Urine, they indicate Nephritick Disorders and a long Indisposition†.

THESE Diagnosticks may all appear at one time or other in the Course of one Paroxysm; but generally the Symptoms are in a greater or lesser Degree, and sometimes one, sometimes another shows itself according to the *Nature* of the Stone, and the particular *Place* where it is lodg'd. If it as yet remains within the *Body* of the *Kidney*, and has not enter'd the Head of the *Ureter*, the Pain will be obtuse and easily born; the Substance of the *Kid-*

* Lib. de intern. affect. Sect. 15. Id. lib. Epidemic. 6. Sect. 1.

† Aphorism. 34. Sect. 7.

they being very sparingly furnish'd with Nerves. Nay it is certain that it may lie a long time, without creating any remarkable Inconvenience, from several Examples in daily Practice, of such a Body's being found in this Part, which has fill'd the *Pelvis*, all its Branches, and even possessed the greatest Part of the *Kidney*, and, yet the Subjects, from whom it was taken, have labour'd under no very painful Symptoms, nor have had but very little Warning before some accidental Shock has unfortunately alter'd its Position, and so brought on a *Paroxysm* that ended fatally. Agreeable to this, *Heurnius* *, upon opening a Patient, took out of one *Kidney* seventy small Stones, and from the other *fourscore*, and yet the Person had never before complain'd of any Nephritick Symptoms. And *Bonetus* † relates from *Anton. de Pozzis*, that he found in each *Kidney* a Stone weighing six Ounces, without any previous Symptoms either of Gravel or Numbness in the Loins, or a Diminution in the Quantity of Urine, it flowing more copiously, but limpid as Water, only attended with an insatiable Thirst.

BUT when the Stone moves into the Head of the Ureter, and twitches and distracts its extreme sensible Membranes, the Pain will be acute, pungent and lancing, and all the other Symptoms vehemently exaggerated. The Vomiting will be frequent and violent; because the Stone irritating the Branches of the Intercostal Nerve, the *Par Vagum* will suffer by Consent, being intimately interwoven with the former, and both together making one Plexus in this Part of the Body. Hence the Animal Spirits will flow convulsively and in great Plenty to the Sto-

* *Fernelli Opera à Heurnio Edit. Part. 2. Lib. 6. cap. 12.*
 † *Medicin. Septentrional. Lib. 3. de imo Ventre, Sect. 25. cap. 6.*

mach, which receives Nerves from the *Par Vagum*; by which means its Fibres will be brought into spasmodick Contractions, which will forcibly throw out any Contents lodged therein.

THERE will be a *Numbness* felt in the *Thigh* and *Leg* of the Side affected, both by Reason that the *Psoas Muscle*, upon which the *Kidney* and *Ureter* lay, will be compressed by this extraneous Body; and forasmuch as the *Nerve* that is sent off from the Spinal Marrow, and is distributed through the *Crural Muscles* will undergo the like Compression: whence the free Influx of the Animal Spirits into the Muscles being partly taken off, such a Sensation will naturally arise. And to the same Cause, together with the Nerves of these Parts, being convulsed by the *Stimulus* of the *Stone*, is owing that Difficulty of walking upright observable in the Fit.

THIS convulsive Contraction from the Violence of the Pain, will be propagated to all the Parts that lie continuous, and have any near Relation to those immediately affected. For which Reason the *Peritoneum*, in whose Duplicature the *Kidney* is plac'd, and which gives an outward Coat to it, as also the *Vasa Preparantia*, which run between its *Lamellae*, and are furnish'd with Nerves from the same Pair that the *Ureters* are, will be considerably contracted, and draw up the *Testicle* to which they are affix'd. But this Symptom proceeds likewise in great Measure, if not principally, from the præternatural Shortness of the *Ureter* at this Time; whereby the *Vas Deferens*, which passes over it and between it and the *Bladder*, will be pull'd up by the *Ureter*, and draw the *Testicle* after it.

As all these Symptoms are aggravated whilst the *Stone* remains in the *Ureter*, so they abate or altogether

together cease, as soon as it has pass'd into the *Bladder*. In like Manner the other concomitant Signs vary according to the Nature of the *Stone*: If it is so large as to plug up the Orifices of the *Ureter* or *Papilla*, and both *Kidneys* affected, the Urine will be *totally suppress'd*; or if it is so big, or plac'd in such a Manner, as not to give Room for the solid Contents to pass through, the Urine will be *thin, aqueous* and *limpid*. If the *Stone* by its pointed Surface should have lacerated the Blood-Vessels, or by its Bigness very much distended the *Urinary Ducts*, as it mov'd through them, in both Cases the Urine will be *bloody*. If its Cohesion is so lax, as easily to be broken, some of its Parts will be wash'd away gradually by the transfluent Urine; or if it occasions a *Paroxysm*, before it is much indurated, a Portion of Sand adhering to its Surface will be abraded by the same Transflux; in both which Cases there will be a *frequent Secretion of sabulous Matter*: And if it is of a firm Consistence, but small enough to move through the *Ureter*, though with the utmost Difficulty, it will be voided *entire*.

BUT there is another Reason, besides this now given, why the Urine at the Beginning of a Fit should be pale, and made in small Quantities, but in its Decline become turbid and discharg'd copiously, which at the same Time has no Relation to the Nature of the *Stone*; and that is, because this præternatural Substance irritating the *Kidney*, the *Tubuli Urinarii*, which are the separating Canals, will be very much contracted, as lying so near the greatest Force of the *Stimulus*: By which Means, there will not only be very little Urine separated during such Circumstances, but likewise what is, will be thinner than usual, the more gross Parts of it not being small enough to pass through their

Orifices in this contracted State ; or if they do, will stagnate at the *Papilla*. And these Effects will be propagated in some Degree also to the other *Kidney*, as it is furnish'd with Nerves from the same *Plexus*. But when the *Stone* has mov'd through the *Ureter*, or the *Stimulus* it occasions is eluded by proper Remedies, these small Tubes will be relax'd, and recover their former Dimensions ; whereby a larger Quantity of Urine will be separated, and those solid Particles that stagnated in them wash'd away, which mixing with the Urine will make it turbid.

If we reflect on the Nature of these Diagnosticks, we shall find, that though all of them taken together are Directions sufficient to pronounce the Complaint to be the *Stone*, yet when considered separately, many of them are *equivocal*, and may spring from other Causes : And it is commonly known, that the Symptoms of the *Cbolic* bear so near a Resemblance to many of these, that it is frequently difficult to distinguish between them. Indeed when any of the *Pathognomonick* Signs appear, as Sand or small Stones in the Urine, the Cause stands confess'd ; or if the Urine is bloody, and a Numbness perceiv'd in the Thigh and Leg, we may know that it is not the *Cbolic* : But when none of these shew themselves, the Cause is still latent, and must be discovered by some distinguishing Characteristicks peculiar to itself. These were first mark'd out by *Galen*, from whom all succeeding Writers have borrow'd or rather copied what they have wrote on this Subject : To whom therefore I refer the Inquisitive ; and so much the rather, because it will thence appear, that some beneficial Knowledge may be got from *Galen* too, though one of the ancient Writers of the Faculty.*

* Galen de loc. affect. lib. 6. cap. 2.

THE Symptoms likewise that arise when the *Kidneys* are *hysterically* affected, mimick a *Nephritick Fit*, not only in the Nature and Situation of the Pain, and the exorbitant Vomiting which attends it, but also the Propagation of it into the *Ureters*, &c. and are not easily distinguish'd, unless from the *previous Disposition* of the Patient to one Complaint more than the other, or from the Discharge of a *porraceous* Matter by Vomit, or from the constant *Limpidness* of the Urine, which in the *Hysterick Affection* continues in the same Condition all the Time it lasts, whereas in the other it grows higher colour'd and turbid. A *Rheumatick* Pain in the Loins produces the same Effects, but may be discern'd from the Difficulty the Patient finds in *raising* his Body from a bending Posture to an erect one, and the *Sensation* arising thereupon; which is as if he was cut through the middle. The last I shall mention is the *Nephritis* or *genuine Inflammation* of the *Kidney*, which resembles a *Nephritick Paroxysm* in most Points, but may be known from the *acute Fever* that constantly attends it; and from the *revers'd Condition* of the Urine; which in this Disease is red and flammeous at the Beginning; but when the Inflammation is at the greatest Height, it becomes aqueous and limpid, whereas in the *Nephritick Paroxysm* it is just the contrary.

THE *Prognostick* during a *Paroxysm*, is taken from the Vehemence and Duration of the Symptoms, and the different Appearances that arise in the Course of it; which any one may foresee the Consequence of, who is acquainted with the Reason of their appearing. As to the Disease in general, in *old People* who have been harass'd with many *Shocks* of it, and whose *Urine and Kidneys* have
been

been a long Time faulty, it is incurable *: According to which *Aretæus* has observ'd, that it is more difficult to prevent the *Kidneys* and *Bladder*, than are obnoxious to a calculous Disposition, from generating these Substances, that it is to make a *Prolifick Womb barren* †. When it proceeds likewise from an *hereditary Disposition*, or if at the same Time there is an *Ulcer* in the *Kidneys* ‡, the same Judgment is to be made: and indeed at best the general Prognostick is melancholy enough; the most that a Physician can do, being to relieve the Patient from a present Fit, and ward off another as long as he can.

THE Indications of Cure during a *Paroxysm* are to force the *Stone* into the *Bladder*; to facilitate its Passage thither, by relaxing and enlarging the Dimensions of the *Ureters*, that they may yield and give way to its Motion; to guard them against the Hardness and Asperity of its Substance, that it may not injure them in its Way; and lastly, to mitigate and take off the exorbitant Symptoms.

1st. THE first is answer'd by a plentiful Administration of *Diuretick Medicines*; especially such, as by their attenuating and deterfive Qualities do thin viscid Humours, and scour the Vessels they pass through. But since in the present Case there is a great Stricture and Tension of the Parts from the Violence of the Pain, and as the *stronger* Diureticks act with a *Stimulus*, it is unsafe to use them; lest instead of forcing a Passage they should contract and straiten what was too strait before: The only Remedies of this Class then, that can safely

* Hippocrat. aph. 6. sect. 6. † De curatione Morbor. diuturn. lib. 2. cap. 3. ‡ Sennertus lib. 3. Part. 7. Sect. 1. cap. 6.

be administred with a free Hand, are those, which at the same Time they increase the Quantity of the Urine, do by their *balsamick* Properties and *Smoothness* lubricate and relax the Urinary Passages: Upon which account the *Turpentine*s and *Balsams* are of singular Service in these Complaints; especially when blended with Medicines appropriated to the next Intention.

2dly. THIS indicates the Use of *emollient*, *lenient* and *anodyne* Remedies; of which Sort are oily Compositions, and such Roots and Herbs as abound with smooth mucilaginous Juices; which, at the same Time they relax the solid Fibres, do by their Smoothness and Viscosity blunt the Acrimony of the Humours, and defend the Passages from the Roughness of the *Stone*. *Emollient Clysters* injected at proper Intervals very much contribute to these Ends; both as they empty the *Colon* of Wind and Excrement, which distending the Intestine, cause it to press against the *Kidney* and *Ureter*; and as by their kindly Warmth and softening Quality they relax its Fibres, and communicate the same Effects to the Parts contiguous. For the same Reason a *Purge* is necessary, when the smaller Intestines are loaded with a *Saburra* of crude Humours, which are out of the Reach of a Clyster's Operation; which frequently happens in this Case. But what is of the most signal Benefit in this Intention is the use of warm *lenient Baths*, which introduce an universal Relaxation of the Passages. This is directed by *Hippocrates**, who always directs judiciously; For Experience teaches, that there is more Advantage found from a gentle Medicine administred whilst sitting in *Semicupio*, than from all the *Farrago* of *Lithontripticks*, or the most pompous Means

* Lib. de intern. affect. Sect. 15.

whatsoever.

whatsoever. The present Age, so fruitful of Discoveries, has not yet found out a Specifick of this Virtue; much less might we expect it from the Antients. *Galen* therefore cannot be esteem'd the less for frankly declaring, that in his time no Remedy was discover'd which could break a *Stone*; but that the whole Cure depended on *Surgery* and *Incision*.

3dly. As to the Symptoms, the first to be attended to is the excessive Pain. And this is of such Consequence, that unless it is assuag'd, there is little to be expected from the most rational Process. For as long as this is exorbitant, the Contraction of the Vessels will continue, which will hinder the *Stone's* passing through them. This is alleviated in great measure by the Remedies adapted to the foregoing Intention; but what is particularly indicated here, is *Plebotomy*, and a cautious Use of *Opiates*: the first as it empties the Blood-Vessels, and thereby takes off the Distention; the other as they quiet the Orgasm of the Spirits, and elude the Force of the *Stimulus*. It is therefore with good Reason, that a shining Ornament of our Body lays down, *that no one can more happily go about to assuage Nephritic Pains than by letting Blood* *.

THE Vomiting that accompanies a Fit ceases as soon as the *Stone* has pass'd into the *Bladder*; but as the Stomach is sometimes so affected as to throw up whatever is taken, we must endeavour to mitigate this Symptom by gentle *Stomachicks* blended with *Opiates*, which will take off the Irritation for a while, and give Time to the proper Medicines to pass into the Blood.

* Mead de imperio Sol. & Lun. pag. 85.

IF these means prove unsuccessful, and we have Reason to apprehend that the *Stone* is *larger* than ordinary, which is perceiv'd from the *fix'd heavy Pain*, and the *Absence of any calculous Excretions*, rather than leave the Patient destitute of Help, we must have Recourse to more forcible Methods; such as *Vomits*, *Purges of the stronger Sort*, and the more *powerful Diureticks*: Which from the *Shocks* they give the Parts may possibly remove the *Stone*, and force it through the *Ureter*. But these are to be try'd only in very bad Cases, lest by shifting it from a larger Space into a smaller, they should fix it there irremoveably.

As to *Nephrotomy*, or the cutting into the *Kidney* in order to extract the *Stone*, it has been recommended by *Rosettus*; and the *Philosophical Transactions* informs us, that it was perform'd once with Success by *Dominicus Marchetti*, a Physician of *Padua*, upon a Countryman of our own*. But if we attend to the Parts to be cut through in this Operation, we shall find it only barely possible to succeed; which is not a sufficient Inducement to a wary Practitioner, either for to advise it or undertake it; it being much more eligible to alleviate the Symptoms and wait the Event, than to add to the Patient's Torment, and render his Death more certain.

THE *Prophylactick* Part in this Distemper, in order to keep off another Fit, or to lessen the Frequency of its returning, is partly observ'd by religiously avoiding any of those Errors in the Non-naturals, that are reckon'd among the distant Causes of it. But besides this, we must endeavour to *diminish* the *Salts* introduc'd into the Blood with our

* N°. 223.

Food, by *purging Medicines*, and *moderate Exercise* repeated at proper Intervals.

WE must strive to prevent the Salts from running into *Combinations*, and to *attenuate* any viscid Matter that may unite them together by proper *Diluters*, which by their *Aquosity* will dissolve them; and by *strengthening the Instruments of Digestion*, which will occasion the Chyle to be sufficiently comminuted, and the Salts intimately divided. But we must chiefly aim at *relaxing* and *widening* the Capacities of the *Urinary Passages*, that they may freely admit all the constituent Parts of the Urine through them, which is partly obtain'd from the Use of *Balsamick Emollient Diureticks*, and from *gentle Exercise*; which last by promoting the Circulation drives the grosser Particles of the Fluids through the Capillary Vessels, whilst the *first* enlarges their Dimensions by their relaxing Properties.

AMONGST all the Variety of *Purgers*, none seem so well adapted to answer all these Ends, as some of the *mercurial Preparations*; these not only evacuating the Salts, but having also a peculiar Power of breaking and obtunding their *Spiculæ*, of removing Obstructions and enlarging the Vessels.

THE *Stomachicks* that are of most Service, are such as by their gentle Astringency brace the Fibres of the Stomach, and by their mild grateful Warmth attenuate any viscid Matter lodg'd therein. For as to the *hotter* and *stronger Bitters*, they induce a universal Rigidity in the Fibres of the whole Body; and for that Reason will do more harm than good. *Galen* thought in this Way, when he laid down, that most Medicines proper for calculous Patients
are

are *Bitters* *: But then he tempers them before with this Hint, that by no means it is proper to give such Persons very *heating* Remedies †.

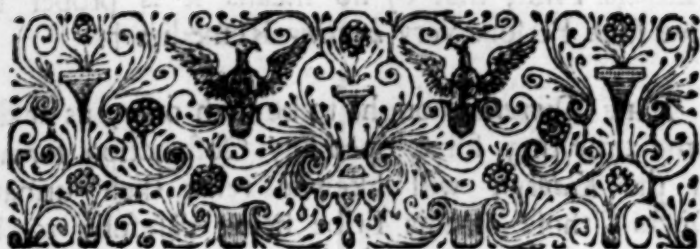
THE *Diureticks* ought to be such only, as at the same time they force open any Obstruction form'd in the *Kidneys*, will likewise relax their urinary Ducts ; those of this Tribe being carefully to be avoided, that are prepar'd from *stony* or *earthy* Substances, which by attracting one another in the capillary Tubes, instead of doing Service, may lay a Foundation for another Fit.

UPON all these Accounts the *Bath*, *Spaw*, and other *Cbalybeate Waters*, are of the utmost Benefit in the Intervals between the Fits, as they *dissolve* the Salts, *strengthen* the Stomach and Bowels, *scour* the Urinary Passages, and carry any *Recrement* out of the Body by *Perspiration* and *Urine*.

* De Composition. Medicament. secund. Loc. Lib. 10.

† De Sanitat. tuend. Lib. 6.





S E C T. III. P A R T II.

Of a STONE in the BLADDER.



WE come now to consider the Consequences that will follow, when a *Stone* has chang'd its Seat, and lodg'd sometime in the *Bladder*. That a *Nucleus* generated in the *Kidney*, when once receiv'd into this *Organ*, is the general Basis of those large Concretions found in it, is evident from inspecting these Bodies; in the Centre of which for the most part is found a solid Substance, of a different Colour and Consistence from the rest of the stony Integuments, over which the adventitious Concretions are spread *lamellatim*, and enclose it as a Shell does the Kernel of a Nut. Not but that a *Stone* may be primarily generated here, without the *Kidneys* being first affected; which not only appears in Children, who are frequently troubled with this Disease without the least previous Complaint of Nephritick Symptoms, but likewise from the Reason of the Thing: For if the solid Parts of the Urine should be deposited in the Bladder in such Manner, as to be brought near to one another, and

not be wash'd away by a following Afflux, they will unite by means of their attractive Powers. This will happen if the Urine is over *viscid* and too much loaded with *saline* and *earthy* Principles; for if it stays any considerable Time before it is voided, these will subside to the Bottom by their own Gravity; where they will consequently be brought into a narrow Compass, and at the same Time may adhere to it by the Tenacity of the Parts that envelope them. Accordingly constant Observation tallies with it; the Urine of Persons subject to these Complaints being generally *thick* and *viscid*, and dropping a *whitish* Sediment which sticks to the Bottom of the Vessel it is contain'd in. Thus then there may be a *Stone* form'd in the *Bladder* without a *Nucleus* previously generated in the *Kidney*: But this is not near so frequent; for the *Bladder* being a large Vessel, and so often distended with Urine, such a Deposition of the solid Contents will very rarely happen; but they will either flow out with the aqueous Vehicle, or else be wash'd away by the Weight of the Urine that so often falls upon them: Whereas a *Nucleus* already form'd being a solid concrete and *ponderous*, it may be so lodg'd, that the Urine may pass over it; or its Surface so pointed as to adhere too closely to be separated: and accordingly we find, that *Stones* are form'd in the *Bladder*, when any *extraneous* solid Bodies have accidentally got in there, which have been the Foundation of the subsequent Incrustations, of which there are many Instances*.

THE Basis of a *Calculus* being laid in this Manner, it will necessarily increase if it stays any considerable Time there. For as it consists of a Substance, which in its Nature is very attractive, it

* *Philosoph. Transact.* N°. 168. 171. 266.

will

will draw the solid Particles of the Urine to it, which are of the same Nature, and will therefore separate from the Fluid and adhere to its Surface; and this attractive Power will be greater as the Surface of this solid Body grows larger; so that a Basis once form'd, the *Stone* will become large in a shorter Time than is commonly imagin'd: Every new Incrustation not only adding to the Quantity of Matter, but increasing the Surface in a very great Proportion. The Disposition of the several *Lamellæ* that compose the *Calculus*, shews that it increases in this Way; for their running *parallel* to one another can be only owing to this force of *Attraction*; by which the solid Particles of the Urine, when brought to a certain Distance from the *Concretion*, are impell'd towards it, and unite themselves to it on all Sides, at equal Distances from its Centre, as near as the Figure of the Place in which it is lodg'd will allow of.

FROM hence it appears, that the *Stones* of the *Kidneys* and *Bladder* are of the *same Nature*, and form'd in the *same Manner*; which I believe will hold good likewise in all *Stones* of the Body, in whatsoever Part they are found, and howsoever they differ in Figure, Colour or Weight: Though the *Effects* produc'd by them will vary, as they are lodg'd in *one Part* or *another*. When such a Substance is in the *Bladder*, it will produce the *following*.

AT first, little or no Disturbance will arise from it; because being small and light, the *Mucus* that lines the *Bladder* is sufficient to guard it from the Hardness and Asperity of its Surface; only the Urine is now and then *intercepted* in its Voidance, when the *Stone* casually falls upon the Orifice of the *Urethra*. But when it grows larger and more
weighty

weighty it will abrade this Mucosity, and twitch and vellicate the nervous Coat ; more especially when it moves from one Place to another. Hence the Urine will become *thick* and *slimy* from the abraded *Mucus* *, which Qualities will increase as the *Stone* grows larger, the Glands separating more *Mucus* as the *Stimulus* grows more forcible. This *Stimulus* at the same Time will extend farther, and create a *Pain* in the Neck of the *Bladder*, which will increase towards the End of *Micturition*, and be propagated towards the End of the *Glans* ; the one because the *Calculus* falls to its more depending Part, the *Neck*, the other because the nervous Coat of the *Urethra* is no more than the Continuation of the same nervous Membrane : And it is no Wonder, that when these Parts, which lie so near, endure a *Pain*, that the more *distant* of the procreative Organs should enjoy only a *Pruritus*. As the Bulk of the *Stone* increases, it will press more forcibly upon these Parts, from whence the Pain will become more *intense*, and a *Weight* perceiv'd in the Region of the *Os Pubis* and in *Perinaeo* : And the Irritation it produces will be extended farther to the *Sphincter Ani* and *Intestinum Rectum*, both these being contiguous to this Part, and receiving Branches from the *same Nerve* ; so that a Desire of going to stool will come upon every Attempt to make *Water*. This must be very *frequent* by Reason of the continual *Stimulus* upon the *Bladder*, which will provoke it to discharge its Contents ; but at the same time it will be voided with the *greatest Difficulty*, and *gut-tatim*, from the Stones lying upon the Orifice of the *Urethra*, and stopping it up : So that the Patient is obliged sometimes to lie in a *supine Posture*, in order to remove it from thence before the *Urine* will pass off. Hence it is not at all surprising,

* Hippocrates Aphorism. 79. Sect. 4.

that when this Body has accumulated, it should occasion a *Difficulty* of moving from Place to Place, since the Pressure of it upon the lower Parts is so great.

THESE are the natural Effects of a Lodgment of the *Stone* in the *Bladder*; but as it does not create all of them at the same Time, but *seriatim* as it grows in Magnitude, its *Diagnosis* is uncertain; so that we are oblig'd to have Recourse to some *Collateral Tokens*, the better to form a surer Judgment of the Case. Thus we must have an Eye to the previous Disposition of the Patient to *Nephritick* Symptoms, which will guide us a little; as also whether the Remedies proper for this Distemper have a *laudable* Effect. But we principally depend upon the Introduction of the *Catheter* into the *Bladder*, or the Finger in *Anum*, though I have known the former to fail; and a *Schirrus* has imitated the *Stone* so artfully in all Symptoms, as to disappoint the *Lithotomist*: Agreeable to which is an Observation of *Baglivi*. * The *Hæmorrhoides* also mimick this Affection; but then the Pain they occasion is not so acute. But the most remarkable Case of this kind is from Dr. *Bamber*, wherein a great Quantity of *topaceous* Substances, that seem'd to me so many Globules of hardned *Excrement*, were lodg'd in the beginning of the *Colon* where the *Ileum* is ingrafted, and pressing upon the *Fundus* created Symptoms which aped the *Stone* of the *Bladder* so nicely, that only Death and Dissection thereupon detected the Fallacy. In this Case it was almost impossible but the most skilful Surgeon should be deceiv'd; for these concreted Substances gave the same Resistance to the *Catheter*, and caused the same Sensation to the Hand that a *Stone* would,

* Praxis Medic. lib. 5. cap. 13. Sect. 8.

when

when in the Cavity of the *Bladder*. However it was very lucky for this Gentleman, considering the censorious Humour of the World, that the Patient died before he underwent the Operation. Sometimes the Surface of the *Stone* is so rough and pointed as to adhere to the inward Coat of the *Bladder*; but then there will be no *Suppression of Urine* along with its other Diagnosticks, as *Aretæus* has observ'd†: From the Absence of which we may justly suspect an Adhesion, if the Patient labours under the other Symptoms. This is a desperate Case, for if you endeavour to extract the *Stone* forcibly, you will lacerate the nervous Membrane of the *Bladder*, upon which will ensue an Inflammation and Mortification of this Vessel, with all the direful Train of consequential Symptoms. But I cannot well conceive how the *Stone* can be enclosed in a membranous *Cystis*; for if so, how can it increase, the *Capsula* keeping any adventitious Concretions from its Surface? Possibly this may not happen before it is grown large, and has adher'd some time; and so by wounding and dividing the nervous Coat, (whilst the Closeness of its Adhesion hinders it from reuniting) it may occasion this Membrane to shoot over it and form a Case for it.

Here I cannot help mentioning an extraordinary Case of the *Stone*, that fell under the Inspection of the famous Dr. *Glisson*, and Dr. *Hugh Chamberlain, sen.* The Daughter of Sir *Hugh Middleton*, who had been before troubled with Nephritick Symptoms, upon riding a Journey unfortunately alter'd the Position of the *Stone*, and turn'd it *transverse*, which brought on a Suppression of Urine which kill'd her; for as one *Kidney* was choak'd up by a large *Stone*, that only officiated, in whose *Ureter*

† De caus. & sign. diuturnor. morb. lib. 2. cap. 4.

the other *Stone* was lodg'd, which occasion'd her Death. Upon opening the Body by Mr. *Holliard* Surgeon, there was found "An Abscess in the
 " left Kidney, with Abundance of purulent Matter,
 " and a brown *bollow* long *Stone* of near two
 " Drams Weight in the Bottom of the *Ureter*, at
 " its Insertion into the *Bladder*. The right *Kidney*
 " was likewise Ulcerous, containing a thicker *Pus*,
 " and at the Bottom of it, at the Ingress of the
 " *Ureter*, a larger whitish *Stone* weighing three
 " Drams, two Scruples and a half." This Case
 being very uncommon from the *Hollowness* of the
Stone through which the Urine pass'd, being the
 first Instance I have any where met with of such a
 one's being found in the *Ureter*, though they are
 sometimes, but rarely, in the *Bladder*, I have
 thought it worth inserting; more especially since it
 has not heretofore been made publick. The *Stones*,
 together with the Case, were left for some Time in
 the Custody of Mr. *Dobyns* Surgeon, but are at
 present in the Hands of Dr. *Middleton Massy*,
 who, to give a clearer Idea of them, has made a
 very accurate *Drawing*, which is here annex'd.
 (Tab. IV. Fig. II.)

CONSIDERING the *nervous* Contexture of this
 Organ, which renders it of a very acute Sense,
 and the important Office it bears in the Animal
 Œconomy, such a Præternatural Substance must
 necessarily *prognosticate* very *bad* Events; and accord-
 ingly, not only the Physicians of the present Time,
 but Antiquity too has registred a perfect Catalogue
 of Evils it induces. A *Suppression of Urine*, the
Fever it occasions, the *Convulsions* it introduces, and
 the *maciated Habit* that follows, are common Effects
 of this Cause*, if it is let stay a long Time in the

* Aretæi de diuturnor. morbor. causis, &c. lib. 2. cap. 3. 4.
Bladder,

Bladder, or the Patient will not submit to the *artificial* Extraction.

THE Method of *Cure* in this Distemper, as far as it regards the *Physician*, which is only, whilst the *Calculus* is small enough to be forc'd through the *Urethra* by medicinal Process, is very much the same with that to be used in the *Stone* of the *Kidney*: And if it is grown to any considerable Size, it is the *Surgeon's* Province, and requires the *Operation*; under whose Hands therefore for the present I leave it.



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* Aretæi de diuturnor. morbor. causis, &c. lib. 2. cap. 3. 4.

Bladder, or the Patient will not submit to the *artificial* Extraction.

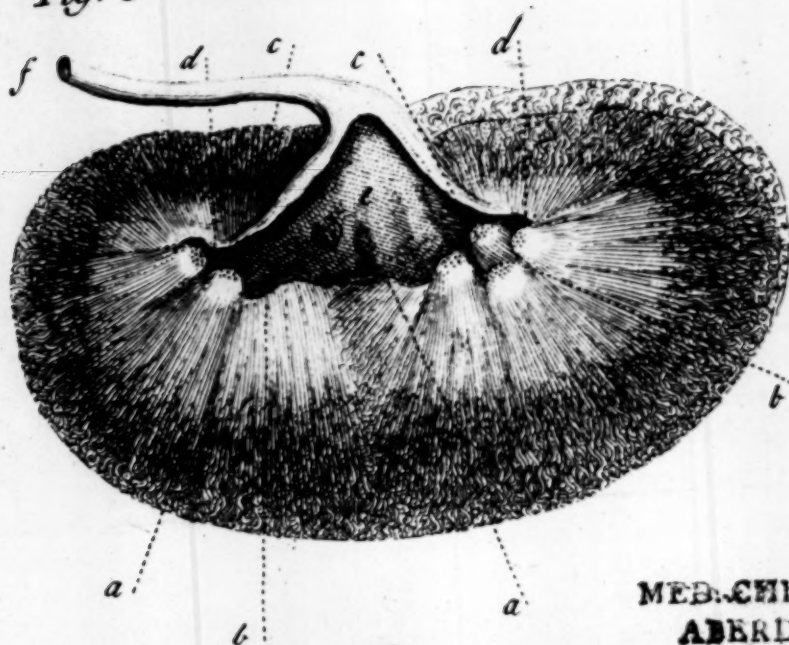
THE Method of *Cure* in this Distemper, as far as it regards the *Physician*, which is only, whilst the *Calculus* is small enough to be forc'd through the *Uretbra* by medicinal Process, is very much the same with that to be used in the *Stone* of the *Kidney*: And if it is grown to any considerable Size, it is the *Surgeon's* Province, and requires the *Operation*; under whose Hands therefore for the present I leave it.



Black, or the patient will not submit to the
surgical operation.

I use Method of Cure in this Discharge, as far
as it regards the Abscess, which is only, whilst
the Cancer is small enough to be laid through
the Breast by surgical Process, is very much
the same with that to be used in the Abscess of the
Breast: And it is a given to any considerable Size,
it is the Surgeon's Province, and requires the Opera-
tion, under whose Hands I have for the present
I leave it.

Fig. 3



MED. CHIR. SOC.
ABERDEEN.

Fig. 1.



MED. CHIR.
ABERDEEN.

Fig. 2.

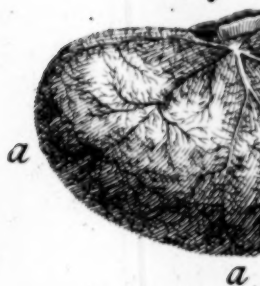
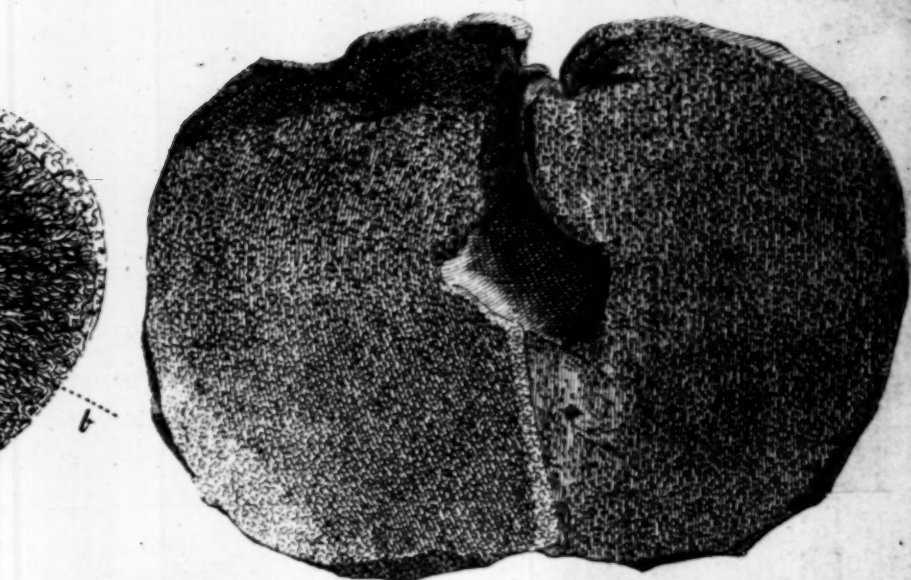


Fig. 4.



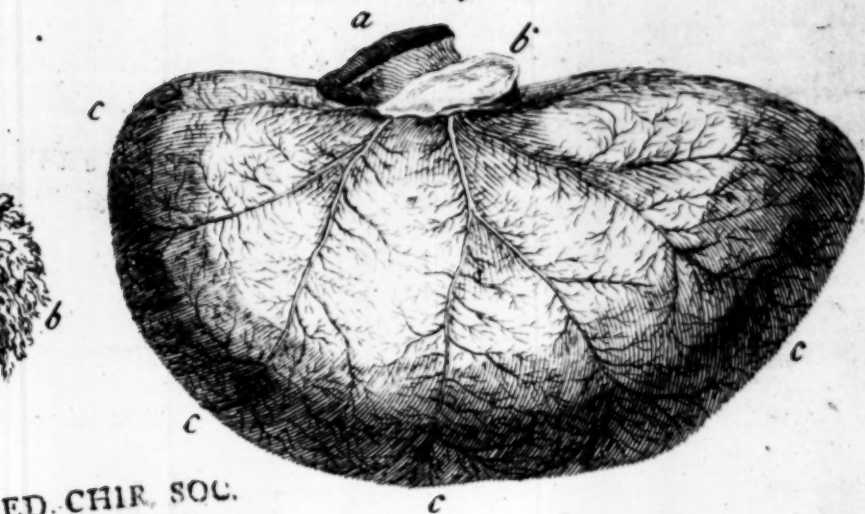
Fig. 2

Tab. 1.



B. CHIR. SOC.
ABERDEEN.

Fig. 4.

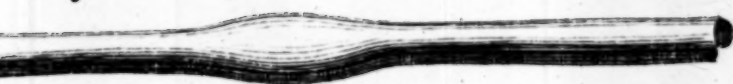


ED. CHIR. SOC.
ABERDEEN.

Fig. 5



Fig. 6





T A B L E I.

FIGURE I.



THE emulgent Artery injected and cleans'd from the Substance of the *Kidney*.

a. Its Trunk.

b b b b b. The minute Ramifications of its smaller Branches, as they are propagated throughout the *Kidney*.

c. A Portion of the *Ureter*.

FIGURE II.

THE numerous Convolutions of the capillary Branches of the emulgent Artery upon the external Surface of the Body of the *Kidney*.

FIGURE III.

The internal Structure of the *Kidney* taken from Dr. *Ruyseb*, with which a Preparation by me exactly corresponds.

a a. The serpentine Progress of the emulgent Artery, before it terminates in the *Bellinian Ducts*.

b b. The said *Ducts*.

c c. The *Papillæ*.

d d. The *Fistulæ Membranaceæ*.

e. The *Pelvis*.

f. Part of the *Ureter*.

FIGURE IV.

THE *Kidney* of an *Hyæna* injected, taken from the invaluable Collection of Sir *Hans Sloane*, in which the emulgent Vein spreads its Branches on its outward Surface.

a. The Trunk of the emulgent Artery.

b. That of the Vein.

c c c c. The various Ramifications of this Vein.

FIGURE

FIGURE V.

THE *Kidney* of a *Cat*, which shews the like Disposition of the *emulgent Vein* in *that Species*.

FIGURE VI.

SHews the unequal Dimensions of the *Ureters*.

TABLE II.

FIGURE I.

REPRESENTS the Urinary Passages in which each *Kidney* has *two Pelvis*, and *double Ureters*.

A. The left *Kidney*.

a. The *emulgent Artery* before its entering the *Kidney*.

b. The *emulgent Vein*.

c. The *exit* of the upper *Ureter*.

d. That of the lower.

B. The right *Kidney* divided longitudinally to shew its peculiar inward Structure.

e. The upper *Pelvis*.

f. The lower.

g. The Substance of the *Kidney* interposed between them.

h. The Head of the upper *Ureter*.

i. The same of the lower.

k k. The Disposition of the four *Ureters* in their Progress towards the *Bladder*.

C. The *Bladder* laid open.

l. The Union of the double *Ureters* before their Insertion into it.

m. The Obliqueness of their Insertions on the right Side,

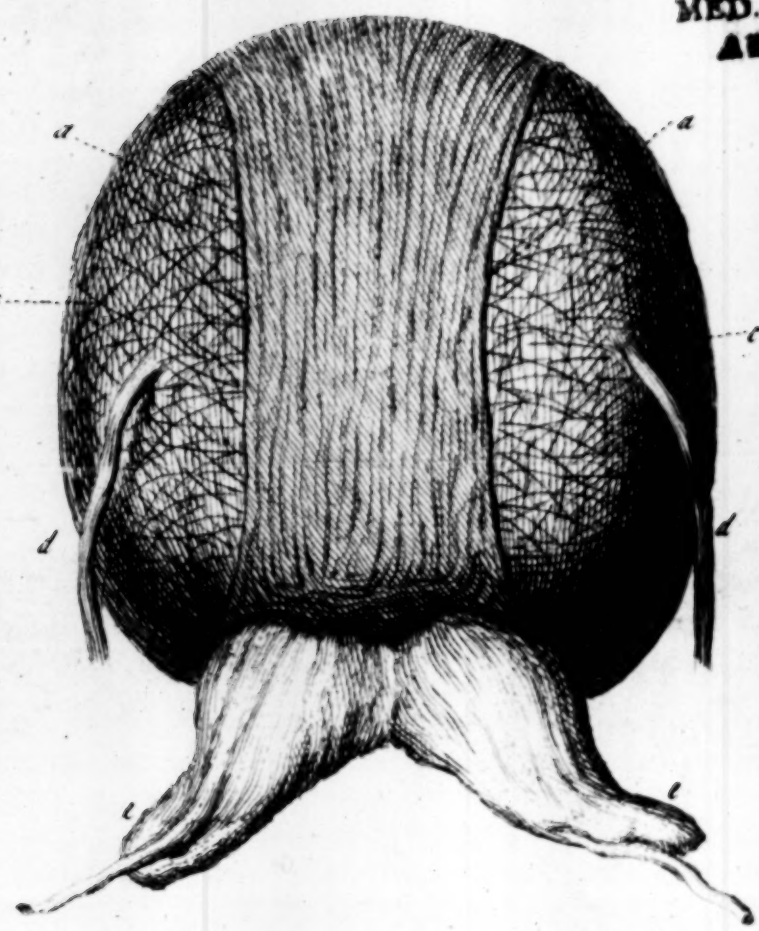
n. Their opening into it on the left.

FIGURE II.

THE *Bladder* of an *Infant*, with part of the *Ureter* injected, in which the Distribution of the *Artery* upon the outward Coat appears.

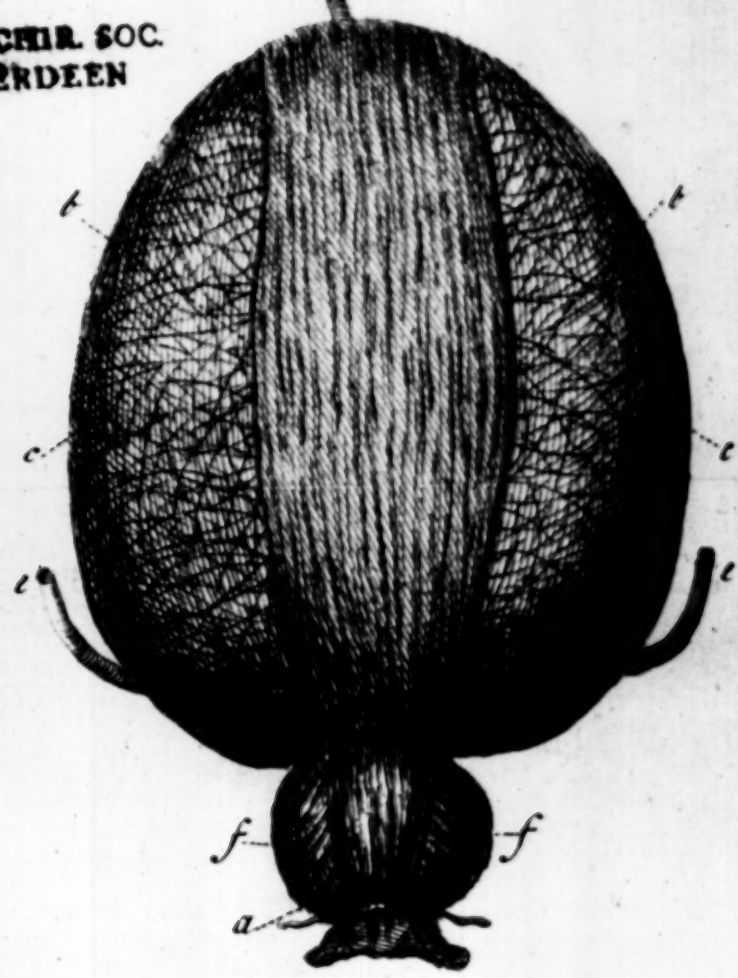
TABLE

Fig. 2



MED. CHIR. SOC.
ABERDEEN

Fig. 1



MED. CHIR. SOC.
ABERDEEN

Fig. 3

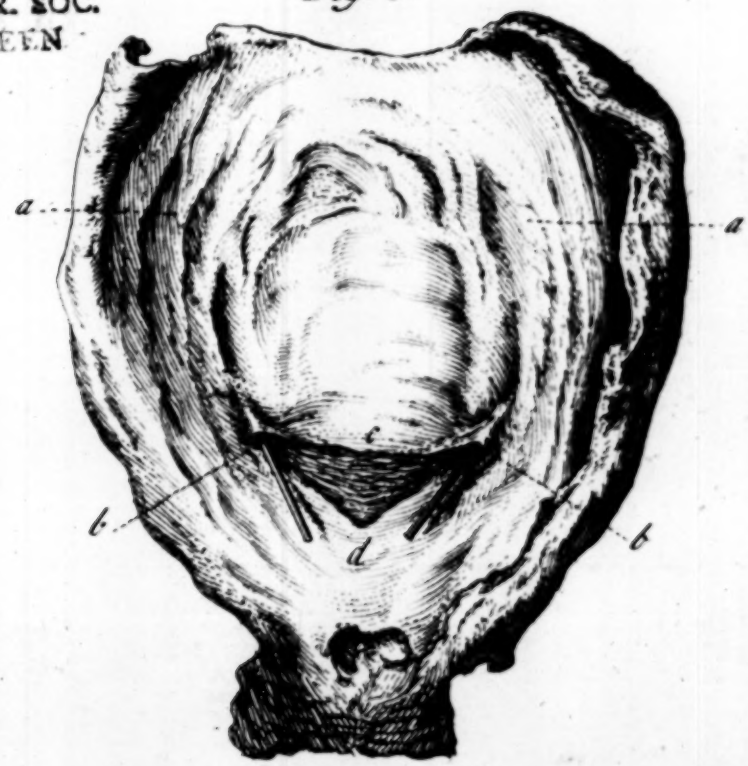


TABLE III.

FIGURE I.

SHEWS the Forepart of the *Bladder of Urine* strip'd of its outward Coat.

a a. The Origin of its *Longitudinal Muscular Fibres*, from the inner and lower Part of the *Ossa Pubis*, and the Fore-part of the *Prostata*.

b b. The Progress of the same Fibres over the Fore-part of the *Bladder*.

c c. The *Oblique Fibres* of its Muscular Coat intersecting each other.

d. The *Urachus*.

e e. A Portion of the *Ureter*.

f f. The *Prostata*.

FIGURE II.

SHEWS the hinder Part of the *Bladder* fore-shorten'd.

a a. The Course of the *Longitudinal Fibres* down this Side of it.

b b. Their Insertion into the Back-part of the *Prostata*.

c c. The *Oblique Fibres*, as in the former.

d d. A part of the *Ureters*, as they appear in this Position of the *Bladder*.

e e. The *Vesiculæ Seminales*, turn'd downwards, to shew the Tendency of the *Longitudinal Fibres*.

FIGURE III.

THE *Bladder* open'd, to discover what is most remarkable within it.

a a. Its *Nervose Coat*.

b b. The *Orifices of the Ureters* that terminate in it.

c. The *fleshy Fibres* extended from each of them.

d. Their Termination in an Angle on the Back-side of the *Bladder*, near its Neck.

TABLE IV.

FIGURE I.

THE lower Part of the *Penis*, with the *Urethra* laid open.

- a a.* The outward Substance of the *Penis*.
- b.* The *nervous Coat* of the *Urethra*.
- c c c c c.* The *Orificula* of the Ducts opening into it.
- d.* A remarkable one very near the *Glans*.
- e.* Another in the upper Part, whose *Duct* runs the Length of an Inch.
- f.* The *Accelerator Urinæ* divided.
- g g.* The *Musculi Eretores*.
- b b.* The *Transversales*.
- i i.* The *Vesiculæ Seminales*.

FIGURE II.

SHEWS a *hollow Stone* in two Positions, which was lodg'd at the Bottom of the left *Ureter*.

- a.* Its *upper Orifice*, through which the Urine from the *Kidney* pass'd.
- b.* Its *lower Orifice* at the Aperture of the *Ureter* into the Cavity of the *Bladder*.

FIGURE III.

- a.* A whitish *Stone*, which plugg'd up the *Right Kidney* of the same Subject.
- b.* A *Frustulum* of the same.

F I N I S.

